MOTOROLA

Level 1 and 2 Service Manual

# Product Families C25 & C43

## Dual Band Wireless Telephone


Talkabout® 191, 190

by Toko (toko@gsm-free.org)

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# Introduction



Motorola® Inc. maintains a worldwide organization that is dedicated to provide responsive, full-service customer support. Motorola products are serviced by an international network of company-operated product care centers as well as authorized independent service firms.

Available on a contract basis, Motorola Inc. offers comprehensive maintenance and installation programs which enable customers to meet requirements for reliable, continuous communications.

To learn more about the wide range of Motorola service programs, contact your local Motorola products representative or the nearest Customer Service Manager.

## Product Identification

Motorola products are identified by the model number on the housing. Use the entire model number when inquiring about the product. Numbers are also assigned to chassis and kits. Use these numbers when requesting information or ordering replacement parts.

## Product Names

Product names included in Product Family C25 and C43 telephones are listed on the front cover. Product names are subject to change without notice. Some product names, as well as some frequency bands, are available only in certain markets.

## Product Changes

When electrical, mechanical or production changes are incorporated into Motorola products, a revision letter is assigned to the chassis or kit affected, for example; -A, -B, or -C, and so on.

The chassis or kit number, complete with revision number is imprinted during production. The revision letter is an integral part of the chassis or kit number and is also listed on schematic diagrams and printed circuit board layouts.

## Regulatory Agency Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. This device may not cause any harmful interference, and
2. this device must accept interference received, including interference that may cause undesired operation.

This class B device also complies with all requirements of the Canadian Interference-Causing Equipment Regulations (ICES-003).

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## Computer Program Copyrights





## About This Service Manual

Using this service manual and the suggestions contained in it assures proper installation, operation, and maintenance of PF C25 and C43 telephones. Refer questions about this manual to the nearest Customer Service Manager.

A product family is the group of products having the same Account Product Code (APC). To locate the APC on a device, refer to “Mechanical Serial Number (MSN)” later in this manual.

### Audience

This document aids service personnel in testing and repairing PF C25 and PF C43 telephones. Service personnel should be familiar with electronic assembly, testing, and troubleshooting methods, and with the operation and use of associated test equipment.

Use of this document assures proper installation, operation, and maintenance of Motorola products and equipment. It contains all service information required for the equipment described and is current as of the printing date.

### Scope

The scope of this document is to provide the reader with basic information relating to PF C25 and PF C43 telephones, and also to provide procedures and processes for repairing the units at Level 1 and 2 service centers including:

- Unit swap out
- Repairing of mechanical faults
- Basic modular troubleshooting
- Testing and verification of unit functionality
- Initiate warranty claims and send faulty modules to Level 3 or 4 repair centers.

## Conventions

Special characters and typefaces, listed and described below, are used in this publication to emphasize certain types of information.

*Note: Emphasizes additional information pertinent to the subject matter.*

*Caution: Emphasizes information about actions which may result in equipment damage.*

*Warning: Emphasizes information about actions which may result in personal injury.*

Enter

Keys to be pressed are represented graphically. For example, instead of "Press the Enter Key", you will see "Press Enter".

Information from a screen is shown in text as similar as possible to what appears in the display. For example, ALERTS or ALERTS or ALERTS.

Information that you need to type is printed in **boldface type**

## Revisions

Any changes that occur after manuals are printed are described in publication revision bulletins (*PMRs*). These bulletins provide change information that can include new parts listing data, schematic diagrams, and printed board layouts.

# Warranty Service Policy

The product will be sold with the standard 12 months warranty terms and conditions. Accidental damage, misuse, and extended warranties offered by retailers are not supported under warranty. Non warranty repairs are available at agreed fixed repair prices.

## Out of Box Failure Policy

The standard out of box failure criteria applies. Customer units that fail very early on after the date of sale, are to be returned to Manufacturing for root cause analysis, to guard against epidemic criteria. Manufacturing to bear the costs of early life failure.

## Product Support

Customer's original units will be repaired but not refurbished as standard. Appointed Motorola Service Hubs will perform warranty and non-warranty field service for level 2 (assemblies) and level 3 (limited PCB component). The Motorola HTC centers will perform level 4 (full component) repairs.

## Customer Support

Customer support is available through dedicated Call Centers and in-country help desks. Product Service training should be arranged through the local Motorola Support Center.

# Parts Replacement

When ordering replacement parts or equipment, include the Motorola part number and description used in the service manual or supplement.

When ordering crystals or channel elements, specify the Motorola part number, description, crystal frequency, and operating frequency desired.

When the Motorola part number of a component is not known, use the product model number or other related major assembly along with a description of the related major assembly and of the component in question.

In the U.S.A., to contact Motorola, Inc. on your TTY, call: 800-793-7834

## Accessories and Aftermarket Division (AAD)

Replacement parts, test equipment, and manuals can be ordered from AAD.

| **U.S.A** | **Outside U.S.A.** |
|---|---|
| Phone: 800-422-4210 | Phone: 847-538-8023 |
| FAX: 800-622-6210 | FAX: 847-576-3023 |

# Specifications

| General Function | Specification |
|---|---|
| Frequency Range GSM | 880-915 MHz Tx (with EGSM)<br>925-960 MHZ Rx |
| Frequency Range DCS | 1710-1785 MHz Tx<br>1805-1880 MHz Rx |
| Channel Spacing | 200 kHz |
| Channels | 174 EGSM |
| Modulation | GMSK at BT = 0.3 |
| Transmitter Phase Accuracy | 5 Degrees RMS, 20 Degrees peak |
| Duplex Spacing | 45 MHz |
| Frequency Stability | ± 0.10 ppm of the downlink frequency (Rx) |
| Operating Voltage | +3.0V dc to +5.1V dc (battery)<br>3.6V, 600mA (external connector) |
| Transmit Current | 185 - 250 mA average talk current drain |
| Stand-by Current | Typically 6mA (DRX2),4mA (DXR9) |
| Dimensions, | 106 mm x 40 mm x 16 mm<br>(4.17 inches X 1.57 inches X.63 inches) |
| Size (Volume) | 68 cc (x.x $in^3$), with 500 mAh battery |
| Weight | 85 gm (2.9 oz), with 500 mAh battery |
| Temperature Range | -10° C to +55° C (+15° F to +130° F) |
| Battery Life, 550 Ni Mh Battery | Talk Time 120 to 300 minutes<br>Standby 50 to 120 hours |
| Battery Charge Time | 3 Hours |
| Alert Volume | 95 dB @ 5 cm |

| Transmitter Function | Specification |
|---|---|
| RF Power Output | 33 dBm nominal GSM 900, 30 dBm nominal GSM 1800 |
| Output Impedance | 50 ohms nominal |
| Spurious Emissions | -36 dBm from 0.1 to 1 GHz, -30 dBm from 1 to 4 GHz |

| Receiver Function | Specification |
|---|---|
| Receive Sensitivity | Better than -103 dBm |
| RX bit error rate (100k bits) Type II | < 2% |
| Channel Hop Time | 500 microseconds |
| Time to Camp | Approximately 5-10 seconds |

| Speech Coding Function | Specification |
|---|---|
| Speech Coding Type | Regular pulse excitation / linear predictive coding with long term prediction (RPE LPC with LTP) |
| Bit Rate | 13.0 kbps |
| Frame Duration | 20 ms |
| Block Length | 260 bits |
| Classes | Class 1 bits = 182 bits; Class 2 bits = 78 bits |
| Bit Rate with FEC Encoding | 22.8 kbps |

# Product Overview



Motorola PF C25 and PF C43 mobile telephones feature global system for mobile communications (GSM) air interface, and wireless application protocol (WAP) Internet browser (PFC25 only). The PF C25 and PF C43 telephones incorporate a new user interface (UI) for easier operation, allows short message service (SMS) text messaging, and includes personal information manager (PIM) functionality. It is a dual-band phone that allows roaming within the GSM 900 MHz and digital cellular system (DCS) 1800 MHz bands. PF C25 telephones support SMS in addition to traditional circuit switched transport technologies.

PF C25 and PF C43 telephones are made of a polycarbonate plastic. The display and speaker, as well as the keypad, transceiver printed circuit board (PCB), microphone, external accessory connector, volume buttons, power button, and voice button, are contained within the flat form-factor housing. The phone accepts both 3V and 5V mini subscriber identity module (SIM) cards which fit into the SIM holder underneath the battery. The antenna is a fixed stub type antenna.

## Features

The PF C25 and PF C43 telephones use advanced, self-contained, sealed, custom integrated circuits to perform the complex functions required for GSM communication. Aside from the space and weight advantage, microcircuits enhance basic reliability, simplify maintenance, and provide a wide variety of operational functions.

Features available in this family of telephones include:

- Ergonomic design for comfort and enhancement of one hand operation
- Icon Based Simplified User Interface
- Animated Screen Savers
- Lower voltage technology that provides increased standby and talk times
- Extended GSM (EGSM) channels
- Tri-coder/decoder (CODEC) that allows full rate, half rate, and enhanced full rate modes of transmission
- Supports SMS, concatenated SMS, and cell broadcast messages
- WAP 1.1 compliant
- 700 $mm^2$ 98 x 64 pixel, high resolution 4 line graphic display
- Icon based simplified user interface
- Display zoom
- Display animation
- VibraCall® vibrating alert
- Voice recorder personal memo feature
- Voice activation for phone book entries and menu shortcuts
- Simplified text entry using iTAP™ predictive text entry
- Supports calling name presentation
- Supports call forwarding for incoming voice, fax, and data calls
- Supports 3V and 5V SIM cards
- SIM Toolkit (STK), Class II

## Speaker Dependant Voice Recognition and Voice Note Recording

This feature allows voice tags to be used for voice dialing up to 20 phone numbers in the phone book and for creating up to 5 voice shortcuts for menu items. The phone must be "trained" by the voice tag being read into the phone's memory twice before it is recognized.

Voice tags can be added to the phone's memory using the usual name addition methods (i.e., via the phone book menu structure or with the shortcut editor).

*The user cannot place or receive calls while adding voice tags to the phone's memory.*

*Because the GSM standard does not provide the option to store voice tags onto the SIM card, voice tags are added to the phone's memory.*

## Wireless Access Protocol (WAP) 1.1 Compliancy

In the WAP environment, access to the Internet is initiated in wireless markup language (WML), which is derived from hypertext markup language (HTML). The request is passed to a WAP gateway which retrieves the information from the server in standard HTML (subsequently filtered to WML) or directly in WML if available. The information is then passed to the mobile subscriber via the mobile network.

The PF C25's microbrowser can be configured for baud, idle timeout, line type, phone number, and connection type.

*Bitmap image data will download as text. If the image is larger than the screen, only part of the image will display.*

*If the user receives a call while in browser mode, the browser will pause and allow the user to resume after completing the call.*

## Simplified Text Entry

There are three different ways to enter text using the phone keypad:

- iTAP™ predictive text entry. Press a key to generate a character and a dynamic dictionary uses this to build and display a set of word or name options. The iTAP™ feature may not be available on the phone in all languages.
- Tap. Press a key to generate a character.
- Numeric. The keypad produces numeric characters only. For some text areas this is the only method available; for example, phone numbers.

## Caller Line Identification

Upon receipt of a call, the calling party's phone number is compared to the phone book. If the number matches a phone book entry, that name will be displayed. If there is no phone book entry, the incoming phone number will be displayed. In the

event that no caller identification information is available, the message INCOMING CALL is displayed.

*User must subscribe to a caller line identification service through their service provider.*

## Call Forwarding

Call forwarding is a network feature that diverts incoming calls to another phone number if the user or phone is unavailable, or the user does not wish to receive calls. This option can be used to:

- Divert all incoming voice calls unconditionally
- Divert incoming voice calls whenever the phone is unavailable, busy, not reachable, or not answered
- Divert incoming fax calls
- Divert incoming data calls
- Allow all calls through to the phone.

Detailed operating instructions for these and the other PF C25 and PF C43 features can be found in the appropriate PF C25 and PF C43 telephone user's guide listed in the "Related Publications" section toward the end of this manual.

# General Operation



## Controls, Indicators, and Input / Output (I/O) Connectors

The PF C25 and PF C40 telephone controls are located on the keyboard. The headphone jack and power jack are on the side and bottom, respectively. Indicators, in the form of icons, are displayed on the LCD (see Figure 1 and Figure 2).


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**Figure 1. PF C25 Controls and indicators locations**

The PF C43 Telephone is similar in appearance to the PF C25 telephone but has a slightly different keypad appearance.

### Function and Keypad Keys

The keys on the front of the telephone (in conjunction with the display) provide the phone's user interface (UI). The function keys, positioned above the keypad, are described in Figure 2.

The PF C25 and PF C43 keypad operates as a conventional telephone keypad. The alpha characters used in text messaging functions are shown in Figure 3.

| Keys | Commands and functions |
|---|---|
| | **Power on/off key**<br>• Long press to switch your phone on/off.<br>• Press to end or cancel a call.<br>• Press to return to the previous menu.<br>• Exit bro ser and back to idle. |
| | **Send/Answer key**<br>• Press to send or ans er a call.<br>• In idle mode, long press to redial the last call number.<br>• In idle, press to display last dialed/missed numbers.<br>• Press to select or activate an option. |
| MENU | **Menu key**<br>• Accessing the main menu from idle.<br>• During a call, press to access the Call Options menu.<br>• During input, press to access the input mode menu.<br>• Bro ser's 2nd soft key. |
| | **Right soft key**<br>Executes the command sho n at the bottom right of the display:<br>• In menus, press to select or activate an option (as **SEL**/**OK**/**OPTION** sho s).<br>• In idle, press to access the Messages menu. (as sho s).<br>• Confirms entered digits/text during input (as **OK** sho s).<br>• Links to the next eb page/selects a bro ser menu option during an Internet session.<br>• Bro ser's 1st soft key. |
| | **Left soft key**<br>Executes the command shown at the bottom left of the display:<br>• In menus, press to abort a selection/operation and return to the previous menu or screen (as **QUIT**/**EXIT** sho s).<br>• In idle, press to access the Phone Book menu (as sho s).<br>• During input, press to clear one digit/character; long press to clear all digits/characters (as **DEL** sho s).<br>• During an Internet session, press to return to the previous page; long press to return to homepage. |
| | **Scroll key**<br>• Scrolling the menus and options.<br>• Adjusting volume during a call.<br>• In idle mode, press to access Quick Access menu.<br>• In idle mode, long press to access phone book directory/ initiate voice dial (if voice dial feature is activated).<br>• During input, press once to move cursor to the next/last insertion point; long press to move the cursor continuously. |
| | **Voicemail key**<br>• In idle, long press to dial the voice mail box number.<br>• During an internet session, long press to access the bro ser menu. |
| | **Lock key**<br>• In idle, long press to lock the keypad. |
| | **Number key**<br>• In idle, long press to dial any of the first 9 phone numbers saved in the Phone Book.<br>• In menus, press to access a corresponding option directly. |

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**Figure 2. PF C25 Function keys**

| Key | Lower case |
|---|---|
| 1 | , . : 1 % ! ? ; ” ' < > ( ) @ & |
| 2ABC | A B C 2 Å Ä å ä à ç æ ß |
| 3DEF | D E F 3 è é É £ Æ $ |
| 4GHI | G H I 4 ì ¡ ? ¤ |
| 5JKL | J K L 5 Δ _ Φ Γ Λ Ω |
| 6MNO | M N O 6 Ñ ñ ò Ö ö Ø ø |
| 7PQRS | P Q R S 7 ¥ § |
| 8TUV | T U V 8 ü Ü ù |
| 9WXYZ | W X Y Z 9 Π Ψ Σ Θ Ξ |
| 0+ | 0 (Space) |
| * | + - * / = |
| # | # P |

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**Figure 3. PF C25 Alphanumeric keys**

## Liquid Crystal Display (LCD)

The LCD provides a high contrast backlit display for easy readability in all light conditions. The large bit-mapped 98 x 64 pixel display includes 3 lines of text, 1 line of icons, and 1 line of soft key labels.

Display animation makes the phone’s menus move smoothly as the user scrolls up and down. Turn animation off to conserve the battery.

*Whether a phone displays all indicators depends on the programming and services to which the user subscribes.*

Figure 4 shows the appearance of the PF C25 display when idle.

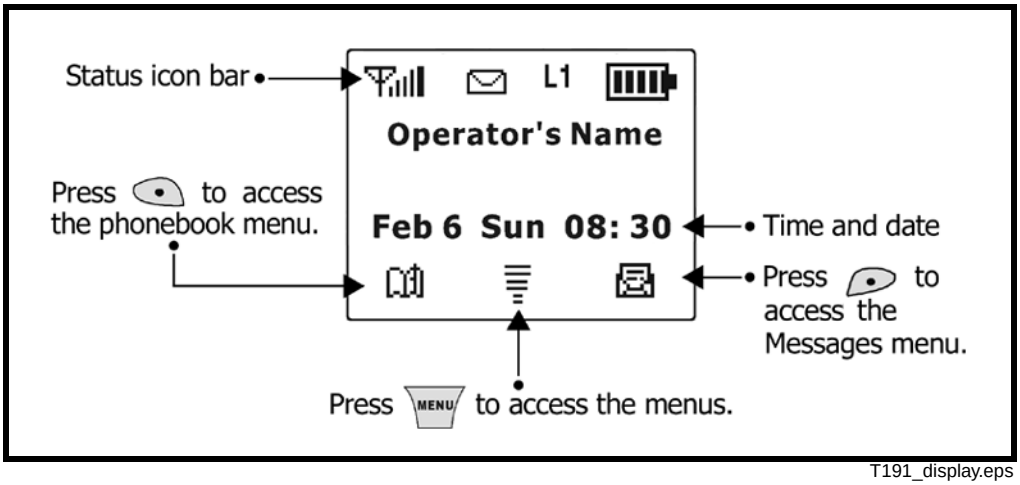


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**Figure 4. PF C25 Idle display**

The phone's icon indicators are shown in Figure 5.

| Icon | Function | Descriptions |
|---|---|---|
| | Signal Strength | Signal strength of your designated network. The more bars displayed, the stronger the signal. |
| | Short message | Receiving a short text message or having unread messages. |
| | Voice mail waiting | You have a new voice mail. |
| | Call divert | All incoming calls are diverted to a designated number. |
| L1 | Line in use | The current line in use. |
| | Vibration only | Your phone only vibrates without ringing when a call comes in. |
| | Battery | Battery power level, the more bars, the more the battery power. Four bars: full. No bars: Recharging immediately. The icon scrolls during charging until the battery is full. |
| | Key lock | Key lock is activated. |
| | Roaming | When your phone is not used on your home network, this icon will appear. |

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**Figure 5. PF C25 Icon indicators**

- **Signal Strength Indicator**. Shows the strength of the phone's connection with the network. Calls cannot be sent or received when the "no signal" indicator is displayed.

- **Short Message**. Appears when the phone receives a text message or has an unread text message. This is a network-dependent feature.
- **Voice Mail Waiting**. Appears when a voicemail message is received. This is a network-dependent feature.
- **Call Divert.** All incoming calls are diverting to a designated number.
- **Line In Use**. Indicates the current line is in use.
- **Vibration Only.** The phone vibrates without ringing when a call is received.
- **Battery Level Indicator**. Shows the amount of charge left in the battery. The more segments visible, the greater the charge. When no bars are visible, recharge the battery as soon as possible.
- **Key Lock.** Indicates that the phone's key pad locked is activated.
- **Roam Indicator**. Appears when the phone uses another network system outside the user's home network. When leaving the home network area, the phone roams, or seeks, another network.
- **Menu Indicator**. Indicates the user can press the menu soft key to open a menu.
- **Clock**. Shows the current time. This is a network-dependent feature.

## User Interface Menu Structure

### Menu Navigation

PF C25 and PF C43 telephones are equipped with a simplified user-friendly interface that employs soft keys and a 2-way scroll key to access phone functions and features. See Figure 1.

"Soft keys" refer to non-labeled keys that correspond to text options displayed on the screen. The left and right soft keys perform the function shown in the corners of the display. The left key will usually select an option whereas the right key will usually exit a function or return to a previous screen.

The menu key opens the initial menu structure, or allows access to a submenu whenever  appears on the screen. See Figure 6 for details of the PF C25 menu structure.

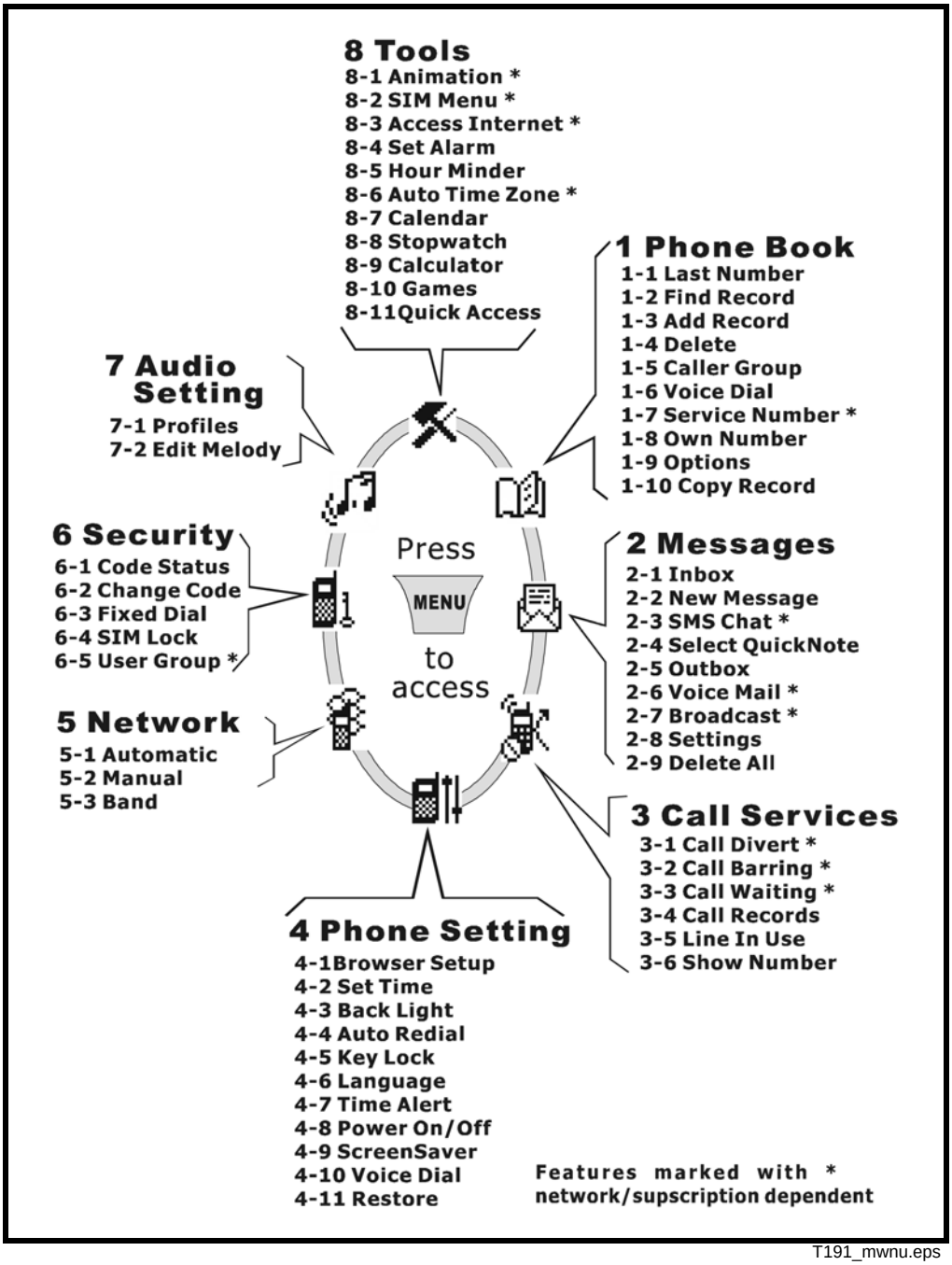


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**Figure 6. PF C25 Menu structure**

## Alert Settings

PF C25 and PF C43 telephones include up to 32 preset alert tones and vibrations that can be applied individually to specific alert events or to all events at the same time.

*Pressing either volume key will mute the alert.*

## Battery Function

### Battery Gauge

The telephone displays a battery level indicator icon in the idle screen to indicate the battery charge level. The gauge shows four levels: 100%, 66%, 33%, and Low Battery.

### Battery Removal

Removing the battery causes the device to immediately shut down and any pending work (for example, partially entered phone book entries or outgoing messages) is lost.

*All batteries can cause property damage and/or bodily injury such as burns if a conductive material such as jewelry, keys, or beaded chains touch exposed terminals. The conductive material may complete an electrical circuit (short circuit) and become quite hot. Exercise care in handling any charged battery, particularly when placing it inside a pocket, purse, or other container with metal objects.*

*If the battery is removed while receiving a message, the message will be lost.*

*To ensure proper memory retention, turn the phone OFF before removing the battery. Immediately replace the old battery with a fully charged battery.*

## Operation

For detailed operating instructions, refer to the appropriate User's Guide listed in the Related Publications section toward the end of this manual.

# Tools and Test Equipment

The following tables list the tools and test equipment used on the PF C25 telephone. Use either the listed items or equivalents.

**Table 1. General Test Equipment and Tools**

| Motorola Part Number[1] | Description | Application |
|---|---|---|
| See Table 6 | Charger | Used to charge battery and to power device |
| 0180386A82 | Antistatic Mat Kit (includes 66-80387A95 antistatic mat, 66-80334B36 ground cord, and 42-80385A59 wrist band) | Provides protection from damage to device caused by electrostatic discharge (ESD) |
| 6680388B67 | Disassembly tool, plastic with flat and pointed ends (manual opening tool) | Used during assembly/disassembly of device |
| RSX4043-A | Torque Driver | Used to remove and replace screws |
| | Torque Driver Bit T-5, Apex 440-5IP Torx Plus or equivalent | Used with torque driver |
| 6680388B01 | Tweezers, plastic | Used during assembly/disassembly |
| HP34401A[2] | Digital Multimeter | Used to measure battery voltage |

1. To order in North America, contact Motorola Aftermarket and Accessories Division (AAD) at (847) 538-8000; Internationally, AAD can be reached by calling (847) 538-8023 or faxing (847) 576-3023.
2. Not available from Motorola. To order, contact Hewlett Packard at (800) 452-4844.

# Disassembly



The procedures in this section provide instructions for the disassembly of PF C25 and PF C43 telephones. Tools and equipment used for the phone are listed in Table 1, preceding.

*Many of the integrated devices used in this equipment are vulnerable to damage from electrostatic discharge (ESD). Ensure adequate static protection is in place when handling, shipping, and servicing the internal components of this equipment.*

*Avoid stressing the plastic in any way to avoid damage to either the plastic or internal components.*

## Removing and Replacing the Battery

*All batteries can cause property damage and/or bodily injury such as burns if a conductive material such as jewelry, keys, or beaded chains touch exposed terminals. The conductive material may complete an electrical circuit (short circuit) and become quite hot. Exercise care in handling any charged battery, particularly when placing it inside a pocket, purse, or other container with metal objects.*

1. Ensure the phone is turned off.

2. Depress the battery latch and slide it in the direction of the arrow (see Figure 7).

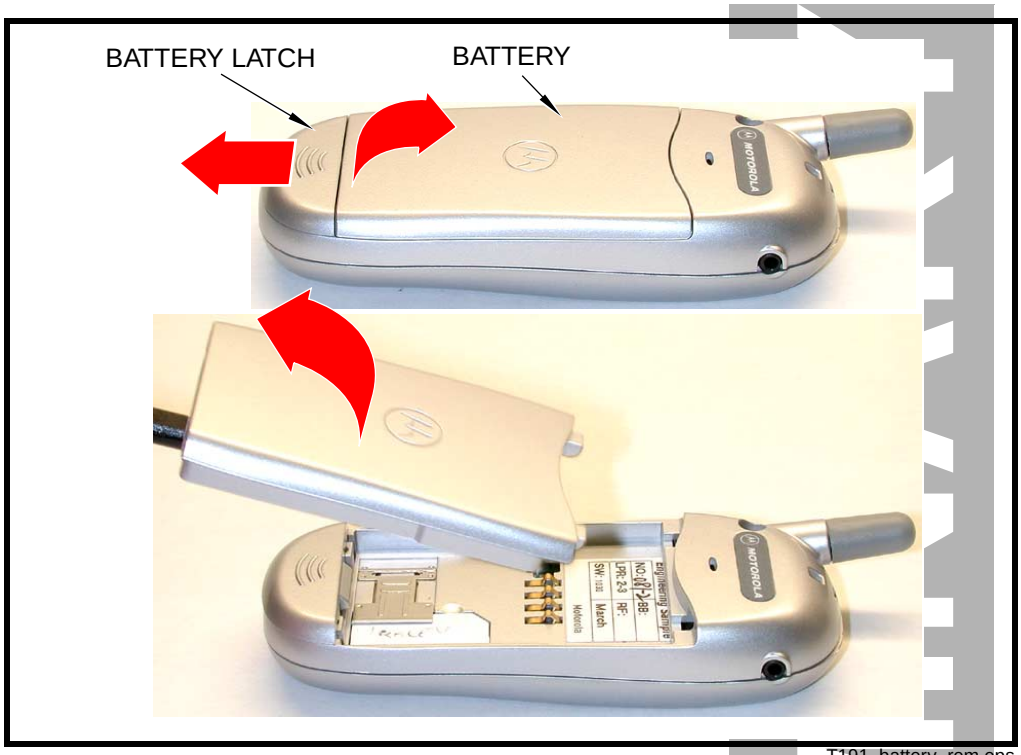


**Figure 7. Removing the battery**

3. Lift the bottom end of the battery from the phone, then remove it completely as shown in the figure.

*There is a danger of explosion if the Nickel Metal Hydride battery is replaced incorrectly. Replace only with the same type of battery or equivalent as recommended by the battery manufacturer. Dispose of used batteries according to the manufacturer's instructions.*

4. To replace, align the battery with the battery compartment so the contacts on the battery match the battery contacts in the phone.
5. Slide the top of the battery into the receptacle molded into the housing, then press the bottom end of the battery securely into the battery compartment until it locks into place.

## Removing and Replacing the Subscriber Identity Module (SIM)

1. Remove the battery as described in the procedures.
2. Slide the SIM latch in the direction of the arrow to unlock as shown in Figure 8.

3. Rotate the SIM and slide it out as shown in the figure.

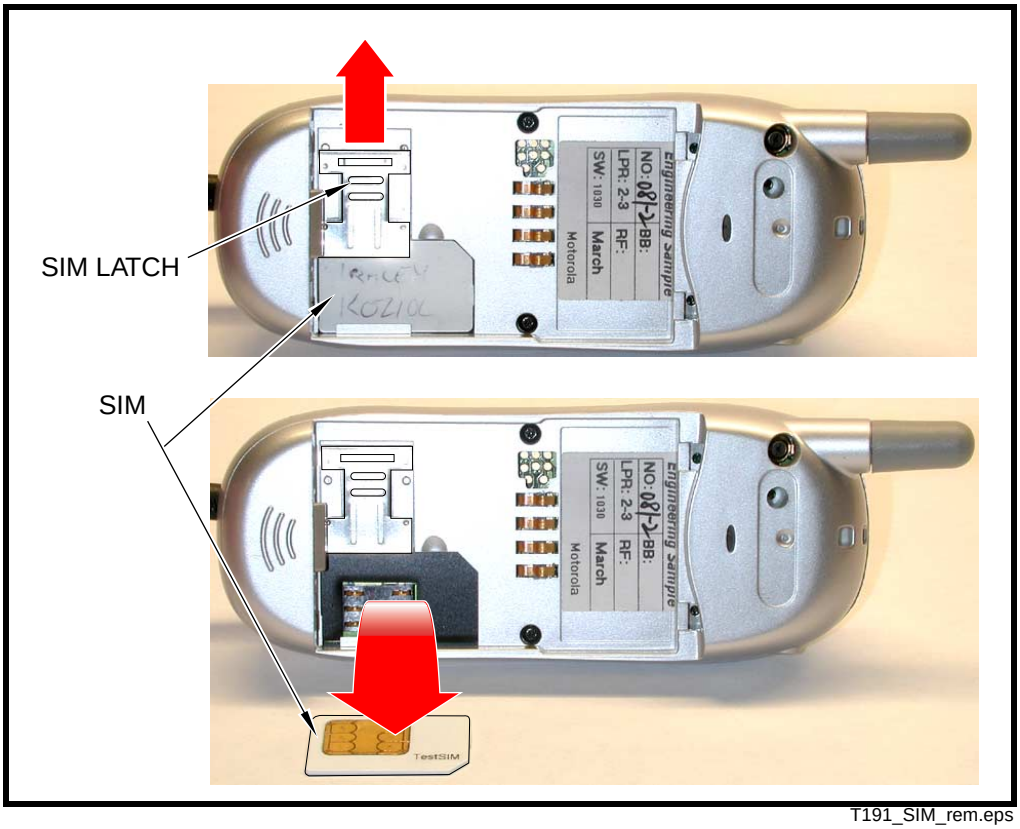


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**Figure 8. Removing the SIM**

4. To replace, carefully insert the SIM into the SIM holder. Be sure the SIM is correctly positioned to contact the terminals when closed.
5. Slide the SIM latch to lock in place.
6. Replace the battery as described in the procedures.

## Removing and Replacing the Rear Escutcheon

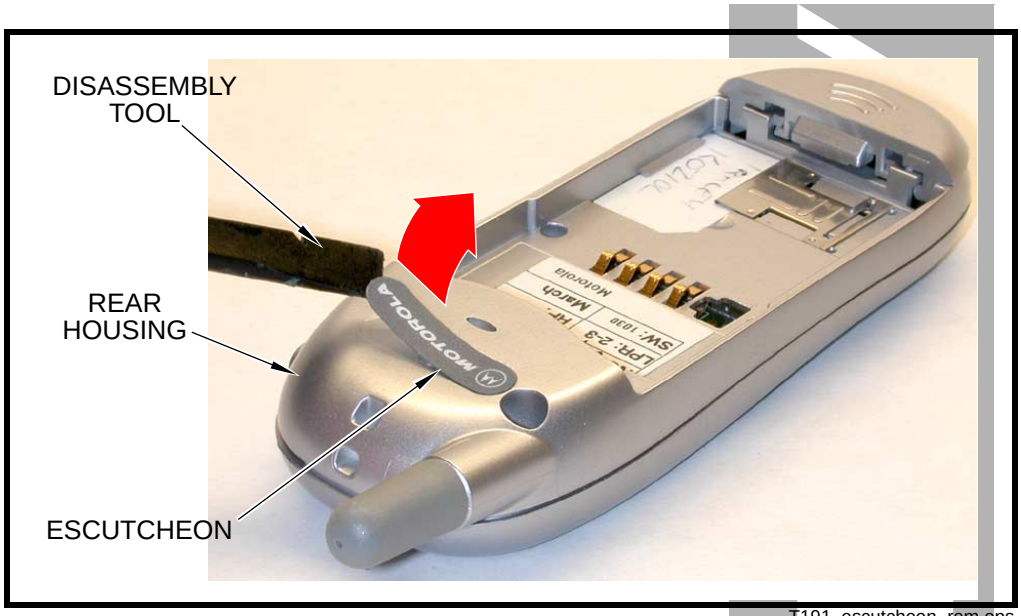


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**Figure 9. Removing the rear escutcheon**

1. Remove the battery as described in the procedures.
2. Using the flat end of the disassembly tool, carefully peel the escutcheon from the rear housing. See Figure 9.
3. To replace, remove the protective paper backing from the new escutcheon and carefully align it with the cavity molded into the rear housing.
4. Press the escutcheon firmly into place making sure pressure is applied evenly across the entire surface to ensure a tight bond.
5. Replace the battery as described in the procedures.

## Removing and Replacing the Rear Housing

*This product contains static-sensitive devices. Use anti-static handling procedures to prevent electrostatic discharge (ESD) and component damage.*

*The housing is fastened with plastic catches. These are delicate and should be parted using utmost care.*

1. Remove the battery and SIM as described in the procedures.

2. Locate the 4 screws holding the front housing to the rear housing. See Figure 10.

*Push the battery latch in the direction of the arrow to expose the 2 bottom housing screws as shown in Figure 10.*

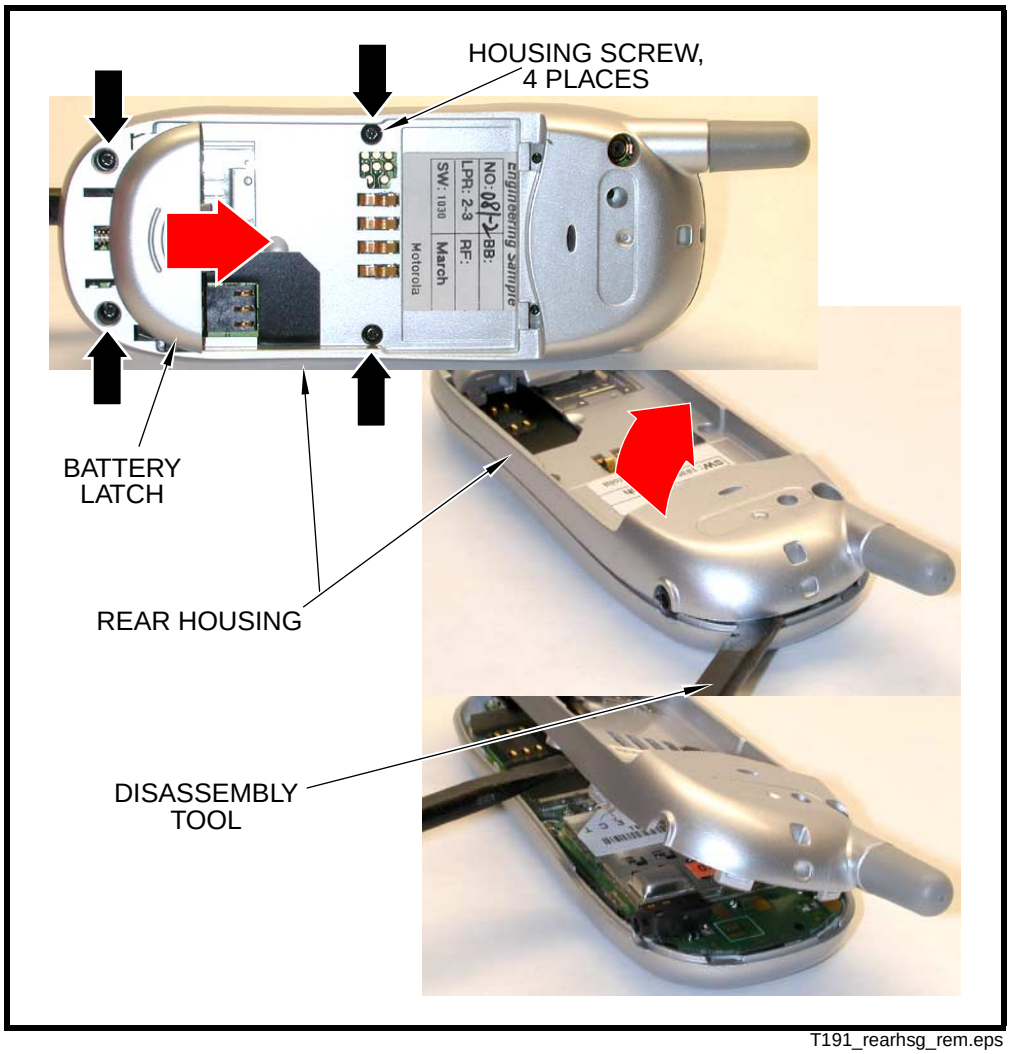


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**Figure 10. Removing the Rear Housing**

3. Using the Torx driver with a T5 bit, remove the 4 screws and set aside for reuse.
4. Using the flat end of the disassembly tool, carefully disengage the catches on the top and both sides of the housing, then separate the rear housing from the front housing.
5. Lift the rear housing from the front housing as shown in the figure.
6. To replace, align the front housing with the rear housing then firmly press together until the catches engage and the housings are properly assembled.
7. Replace the 4 screws and tighten firmly. Do not over tighten.

8. Slide the battery latch toward the bottom of the phone until it snaps into place.
9. Replace the SIM and battery as described in the procedures.

## Removing and Replacing the Antenna

1. Remove the battery, SIM, and rear housing as described in the procedures.
2. Using a firm even pressure, pull the antenna straight out of the rear housing to remove. See Figure 11.

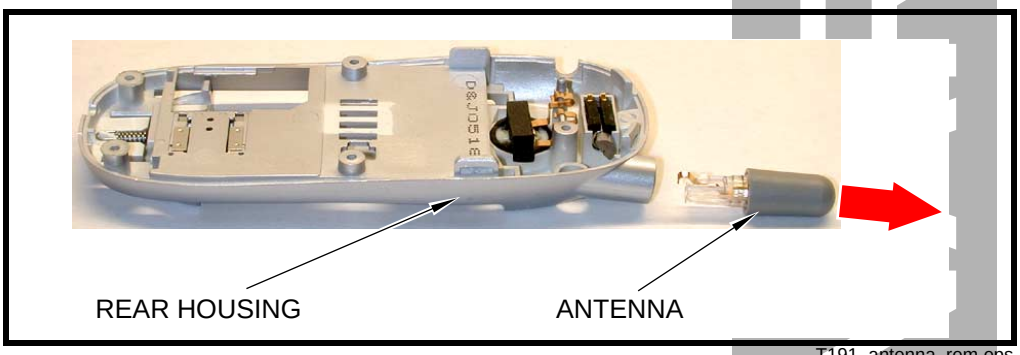



**Figure 11. Removing the antenna**

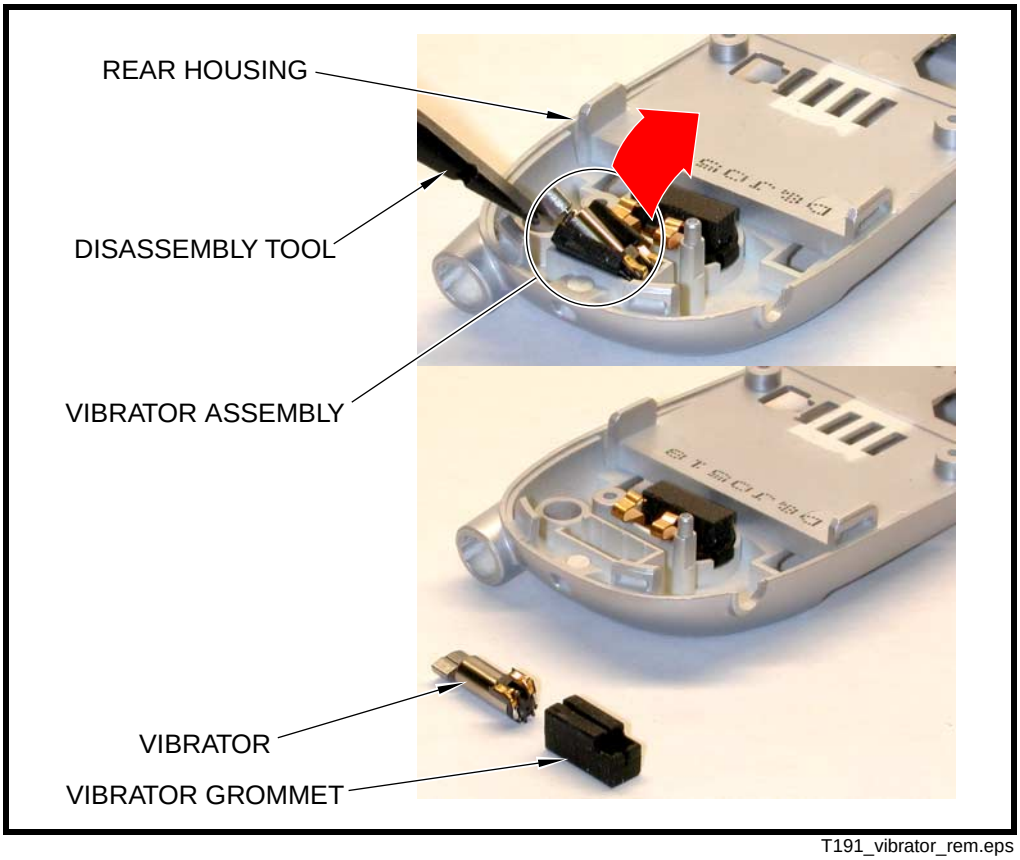
*Exercise caution when handling the antenna to prevent damage to the antenna terminal.*

3. To replace, insert the end of the antenna carefully into the housing and, after ensuring the antenna terminal is correctly aligned to contact the transceiver board when reassembled, push straight into the housing until it snaps into place.
4. Replace the rear housing, SIM, and battery as described in the procedures.

## Removing and Replacing the Vibrator and Vibrator Grommet



1. Remove the battery, SIM, and rear housing as described in the procedures.




T191_vibrator_rem.eps

**Figure 12. Removing the vibrator and vibrator grommet**

2. Using the flat end of the disassembly tool, carefully pry the vibrator assembly from its cavity in the rear housing as shown in Figure 12. The assembly should come away from the rear housing easily.
3. Separate the vibrator from the vibrator grommet.
4. To replace, insert the vibrator into the grommet. Ensure the vibrator shaft can to rotate freely.
5. Align the vibrator assembly with the rear housing so the vibrator terminals will contact the transceiver board contacts when reassembled, then press into place until fully seated.
6. Replace the rear housing, SIM, and battery as described in the procedures.

## Removing and Replacing the Alert Transducer Assembly

1. Remove the battery, SIM, and rear housing as described in the procedures.
2. Using the flat end of the disassembly tool, carefully pry the transducer from its cavity in the rear housing as shown in Figure 13.

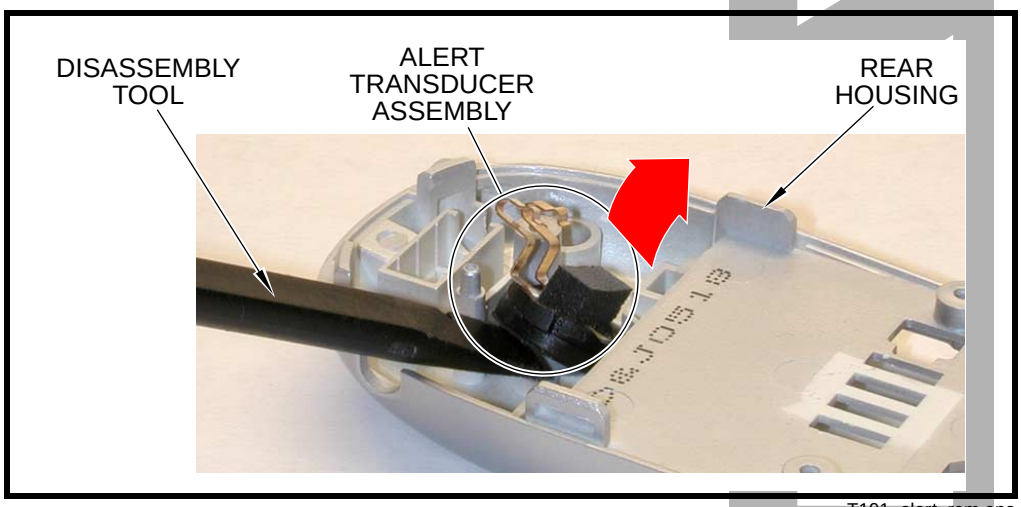



**Figure 13. Removing the alert transducer assembly**

*The alert transducer is fastened to the rear housing with adhesive. Exercise care when removing to prevent damage to the rear housing.*

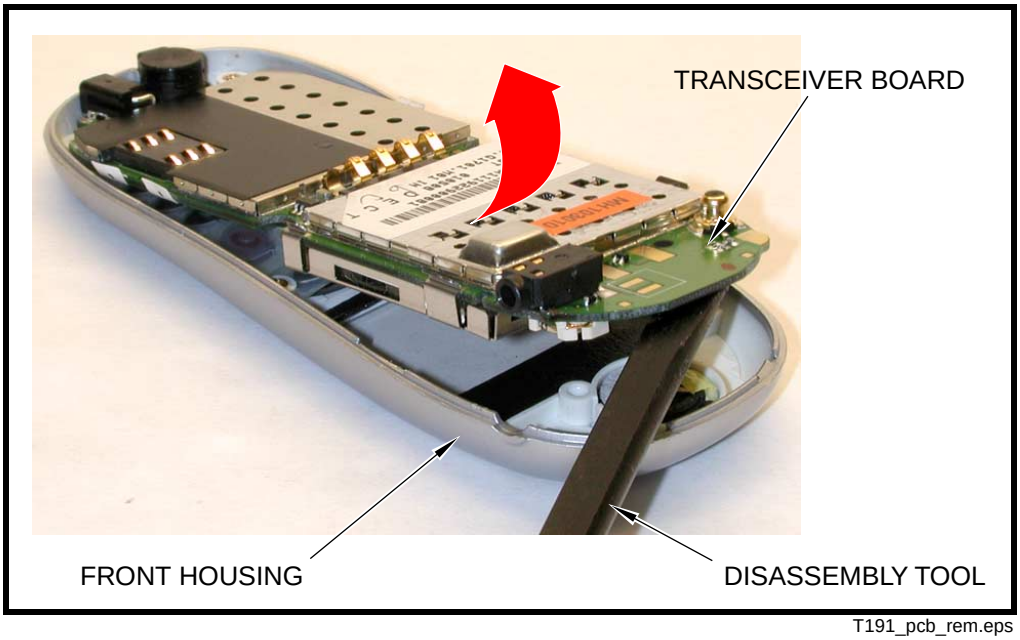
3. To replace, remove the protective backing from the new transducer, then press the transducer into place in the rear housing cavity. Be sure the transducer is straight, fully seated in its cavity, and positioned so its terminals will contact the transceiver board when reassembled.
4. Replace the rear housing, SIM, and battery as described in the procedures.

## Removing and Replacing the Transceiver Board



*This product contains static-sensitive devices. Use anti-static handling procedures to prevent electrostatic discharge (ESD) and component damage.*

1. Remove the battery, SIM, and rear housing as described in the procedures.
2. Using the flat end of the disassembly tool, carefully loosen the transceiver board from the front housing.




T191_pcb_rem.eps

**Figure 14. Removing the transceiver board**

3. Lift the transceiver board completely away from the front housing as shown in Figure 14.
4. To replace, align the transceiver board with the front housing and gently press into place.

*Ensure the keypad is correctly positioned in the front housing relative to the transceiver board. Verify operation of the keys after replacing the transceiver board.*

5. Replace the rear housing, SIM, and battery as described in the procedures.

## Removing and Replacing the RTC Battery

1. Remove the battery, SIM, rear housing, and transceiver board as described in the procedures.
2. Use the flat end of the disassembly tool to pry the real time clock (RTC) battery from its socket on the transceiver board. See Figure 15.

*Dispose of used batteries according to the manufacturer's instructions.*

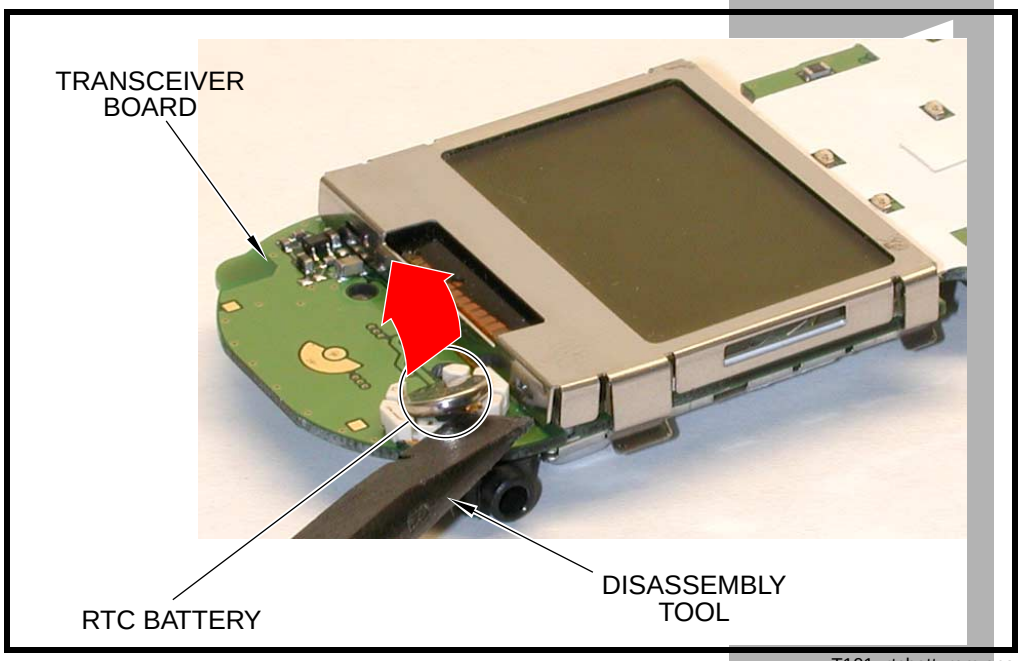



**Figure 15. Removing the RTC battery**

3. To replace, align the new RTC battery with its socket so its positive terminal is facing upward, then snap the battery in place until it is completely seated in the socket.
4. Replace the transceiver board, rear housing, SIM, and battery as described in the procedures.

## Removing and Replacing the Keypad

1. Remove the battery, SIM, rear housing, and transceiver board, as described in the procedures.

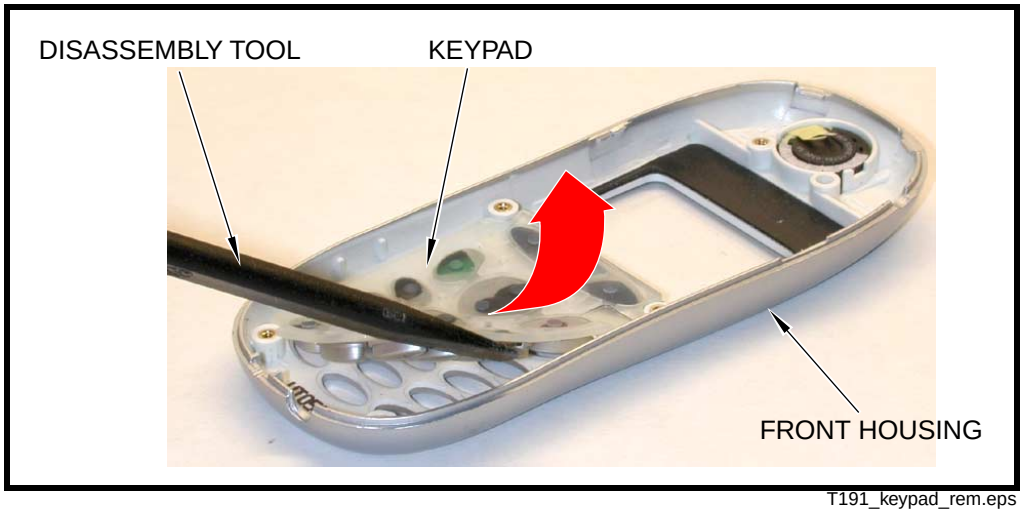



**Figure 16. Removing the keypad**

2. Lift the keypad from the front housing as shown in Figure 16.
3. To replace, insert the keypad into the front housing. Ensure the keys align properly with the openings and the keypad is fully seated in the front housing.
4. Replace the transceiver board, rear housing, SIM, and battery as described in the procedures.
5. Verify correct operation.

## Removing and Replacing the Earpiece Speaker

1. Remove the battery, SIM, rear housing, and transceiver board as described in the procedures.


T191_speaker_rem.eps

**Figure 17. Removing the earpiece speaker**

2. Using the flat end of the disassembly tool, pry the earpiece speaker from its cavity in the front housing.

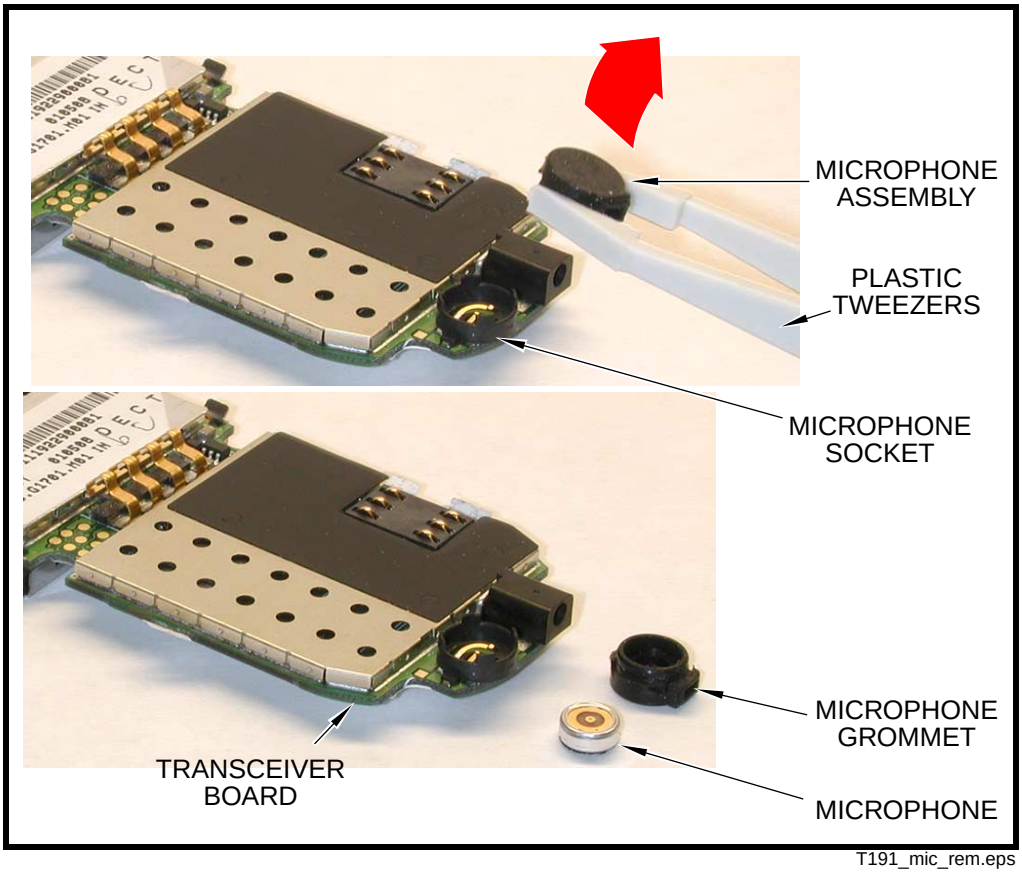
*The earpiece speaker is fastened to the front housing with adhesive. Exercise care when removing to prevent damage to the front housing.*

3. To replace the earpiece speaker, remove the protective backing from the new earpiece speaker, then press the earpiece speaker into place in its front housing cavity. Be sure the speaker is straight, fully seated within the cavity, and positioned so its terminals will contact the transceiver board when reassembled.
4. Replace the transceiver board, rear housing, SIM, and battery as described in the procedures.

## Removing and Replacing the Microphone and Microphone Grommet

*This product contains static-sensitive devices. Use anti-static handling procedures to prevent electrostatic discharge (ESD) and component damage.*

1. Remove the battery, SIM, rear housing, and transceiver board as described in the procedures.




T191_mic_rem.eps

**Figure 18. Removing the microphone and microphone grommet**

2. Using the plastic tweezers, carefully pull the microphone assembly from its socket on the transceiver board. The microphone assembly should come out of its socket easily. See Figure 18.
3. Separate the microphone from the microphone grommet.
4. To replace, insert the microphone into the microphone grommet so the terminals on the bottom of the microphone face outward. Ensure the microphone is straight and pushed completely into the grommet.

5. Align the microphone assembly with the microphone socket press into place until fully seated.

*The microphone assembly is keyed to fit the microphone socket only one way. Be sure the opening in the microphone grommet is positioned to face the opening in the housing when reassembled.*

6. Replace the transceiver board, rear housing, SIM, and battery as described in the procedures.

## Removing and Replacing the Keypad Switch Dome Array

1. Remove the battery, SIM, and transceiver board as described in the procedures.

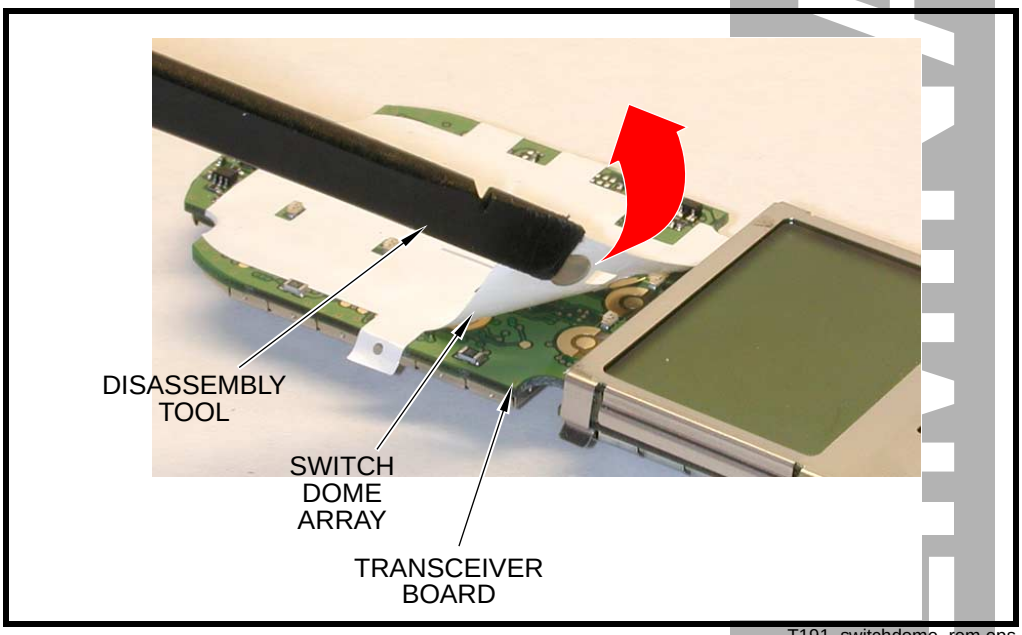



**Figure 19. Removing the keypad switch dome array**

2. While holding the transceiver board stationary, carefully work the flat end of the disassembly tool under a corner of the keypad switch dome array as shown in Figure 16.
3. Slowly peel the keypad switch dome array from the transceiver board to remove. Discard the keypad switch dome array just removed.

*Do not touch the adhesive on the back of the keypad switch dome array or poor adhesion and improper operation may result.*

4. To replace, remove the protective backing from a new keypad switch array.
5. Align the new keypad switch dome array with the transceiver board.

6. Apply even pressure across the entire surface of the switch dome array to ensure proper adhesion.
7. Replace the transceiver board, rear housing, SIM, and battery as described in the procedures.
8. Verify correct operation.

# SIM Card and Identification

## SIM Card

A SIM (Subscriber Identity Module) card is required to access the existing local GSM network, or remote networks when traveling (if a roaming agreement has been made with the provider).

The SIM card contains:

- All the data necessary to access GSM services
- The ability to store user information such as phone numbers.
- All information required by the network provider to provide access to the network.

## Identification

Each Motorola GSM device is labelled with a variety of identifying numbers. The following information describes the current identifying labels.

### Mechanical Serial Number (MSN)

The Mechanical Serial Number (MSN) is an individual unit identity number and remains with the unit throughout the life of the unit.

The MSN can be used to log and track a unit on Motorola's Service Center Database.

The MSN is divided into 4 sections as shown in Figure 20.

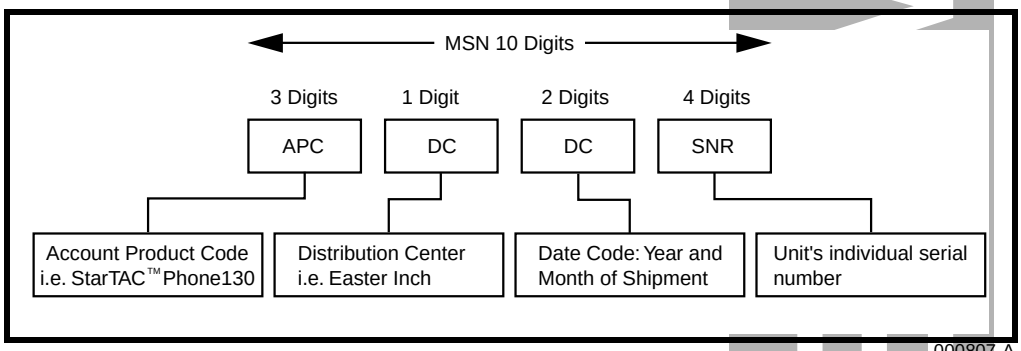



**Figure 20. MSN Label Breakdown**

## International Mobile Station Equipment Identity (IMEI)

The International Mobile station Equipment Identity (IMEI) number is an individual number unique to the PCB and is stored within the unit's memory. The following diagram illustrates the various parts of this number.

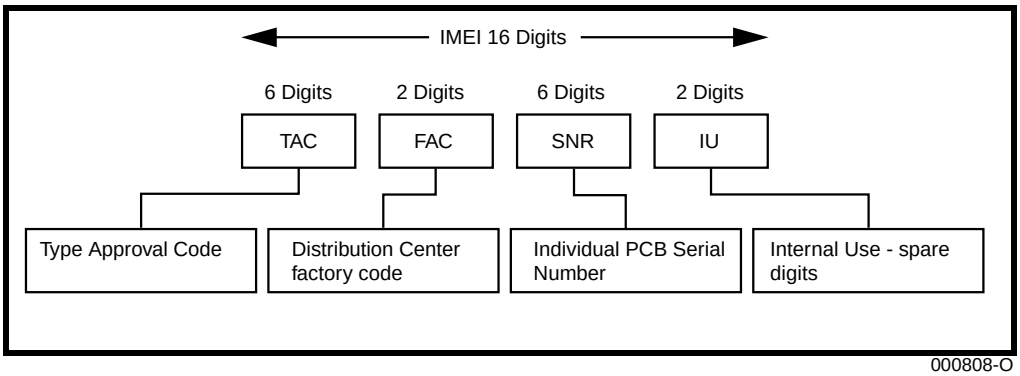



**Figure 21. IMEI Label Breakdown**

Other label number configurations present are:

- **TRANSCEIVER NUMBER**: Identifies the product type. Normally the SWF number. (i.e. V100).
- **PACKAGE NUMBER**: Identifies the equipment type, mode, and language in which the product is shipped.

# Troubleshooting

## Manual Test Mode

Motorola PF C25 and C43 telephones are equipped with a manual test mode capability. This allows service personnel to verify functionality and perform fault isolation by entering keypad commands.

To enter the manual test command mode, a GSM / DCS test SIM must be used.

1. Press ⏻ to turn the phone OFF.
2. Remove the battery as described in the procedures.
3. Remove the customer's SIM card from the phone as described in the procedures.
4. Insert the test SIM into the SIM slot.
5. Replace the battery as described in the procedures.
6. Press ⏻ to turn the phone ON.

Press and hold the # button for approximately 3 seconds until TEST displays on the screen. The phone may now be issued test commands listed in Table 2.

## Manual Test Mode Commands

**Table 2. Test Commands**

| Test Command | Test Function/Name |
|---|---|
| *#300# OK | List Software and Hardware version |
| *#301# OK | Full keypad functional test |
| *#302# OK | Acoustic Test [1]<br>1 - Greeting<br>2 - Main Volume Gain<br>3 - Input Cal<br>4 - Output Cal<br>5 - Side In Gain<br>6 - Vox Gain<br>7 - Min Mic Energy<br>8 - More<br>(a) - In Volume Gain<br>(b) - Aux Volume Gain<br>(c) - Silence Prd<br>(d) - Supp Prd<br>(e) - In Volume<br>(f) - Out Volume<br>(g) - Icon<br>(h) - Image<br>(i) - Animation |
| #303# OK | Settings Saved [1] |
| *#307# OK | Engineering Test Mode |
| #400# OK | ADC, Cal val [1] |
| *#402# OK | Adjust display Intensity/Contrast |
| *#403# OK | List the Manufacturing Information |
| 1998 0722 OK | Master Unlock code for Phone and Sim Lock |

**1. Use with care - Contains Calibration factors**

# Troubleshooting Chart

**Table 3. PF C25 and C43 Telephones: Level 1 and 2 Troubleshooting Chart**

| SYMPTOM | PROBABLE CAUSE | VERIFICATION AND REMEDY |
|---|---|---|
| 1. Telephone will not turn on or stay on. | a) Battery either discharged or defective. | Measure battery voltage across a 50 ohm (>1 Watt) load. If the battery voltage is <3.25 Vdc, recharge the battery using the appropriate battery charger. If the battery will not recharge, replace the battery. If battery is not at fault, proceed to b. |
| | b) Battery terminals open or misaligned. | Visually inspect the battery terminals on both the battery and the telephone. Realign and, if necessary, either replace the battery or refer to a Level 3 Service Center for the battery connector replacement. If battery terminals are not at fault, proceed to c. |
| | c) Transceiver board assembly defective. | Remove the transceiver board assembly. Substitute a known good assembly and temporarily reassemble the unit. Depress the PWR button; if unit turns on and stays on, disconnect the dc power source and reassemble the telephone with the new transceiver board assembly. Verify that the fault has been cleared. |
| 2. Telephone exhibits poor reception or erratic operation such as calls frequently dropping or weak or distorted audio. | a) Antenna assembly defective. | Check to make sure that the antenna terminal makes proper contact with the transceiver board assembly. If connected properly, substitute a known good antenna. If the fault is still present, proceed to b. |
| | b) Transceiver board assembly defective. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |
| 3. Display is erratic, or provides partial or no display. | Transceiver board assembly defective. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |
| 4. Incoming call alert transducer audio distorted or volume is too low. | a) Defective alert transducer. | Replace alert transducer according to the procedures. If fault still present, proceed to b. |
| | b) Faulty transceiver board assembly. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |
| 5. Telephone transmit audio is weak. (usually indicated by called parties complaining of difficulty in hearing voice). | a) Microphone misaligned or defective. | Ensure microphone is correctly positioned in socket. If fault still present, replace the microphone as described in the procedures. If fault is not cleared, proceed to b. |
| | b) Transceiver board assembly defective. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |
| 6. Receive audio from earpiece speaker is weak or distorted. | a) Earpiece speaker defective. | Temporarily replace the LCD speaker assembly with a known good assembly. Ensure good connection. Place a call and verify improvement in earpiece audio. If fault is cleared, reassemble the phone with the good assembly. If fault is not cleared, proceed to b. |

**Table 3. PF C25 and C43 Telephones: Level 1 and 2 Troubleshooting Chart (Continued)**

| SYMPTOM | PROBABLE CAUSE | VERIFICATION AND REMEDY |
|---|---|---|
| | b) Transceiver board assembly defective. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble with the new transceiver board assembly. |
| 7. Telephone will not recognize or accept SIM card. | a) SIM card defective. | Check the SIM card contacts for dirt. Clean if necessary, and check if fault has been cleared. If the contacts are clean, insert a known good SIM card into the telephone. Power up the unit and confirm that the card has been accepted. If the fault no longer exists, replace the defective SIM card. If the SIM card is not at fault, proceed to b. |
| | b) Transceiver board assembly defective. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |
| 8. Vibrator feature not functioning. | a) Vibrator defective. | Replace vibrator as described in the procedures. If the fault has not been cleared, proceed to b. |
| | b) Transceiver board assembly defective. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |
| 9. Internal Charger not working. | Faulty charger circuit on transceiver board assembly. | insert a known good discharged battery. Connect a known good charger and verify battery is being charged. If fault still present, replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |
| 10. No or weak audio when using headset. | a) Headset plug not fully inserted. | Ensure the headset plug is fully seated in the jack. |
| | b) Faulty jack on transceiver board assembly. | Replace the transceiver board assembly (refer to 1c). Verify that the fault has been cleared and reassemble the unit with the new transceiver board assembly. |

## Programming: Software Upgrade and Flexing



The following hardware codes must be observed when flashing phones:

| Hardware Code | Region |
|---|---|
| ID1 | EMEA |
| ID2 | Asia |

Contact your local technical support engineer for information about equipment and procedures for flashing and flexing.

# Part Number Charts

The following charts are provided as a reference for the parts associated with PF C25 and C43 telephones.

## Exploded View Diagram

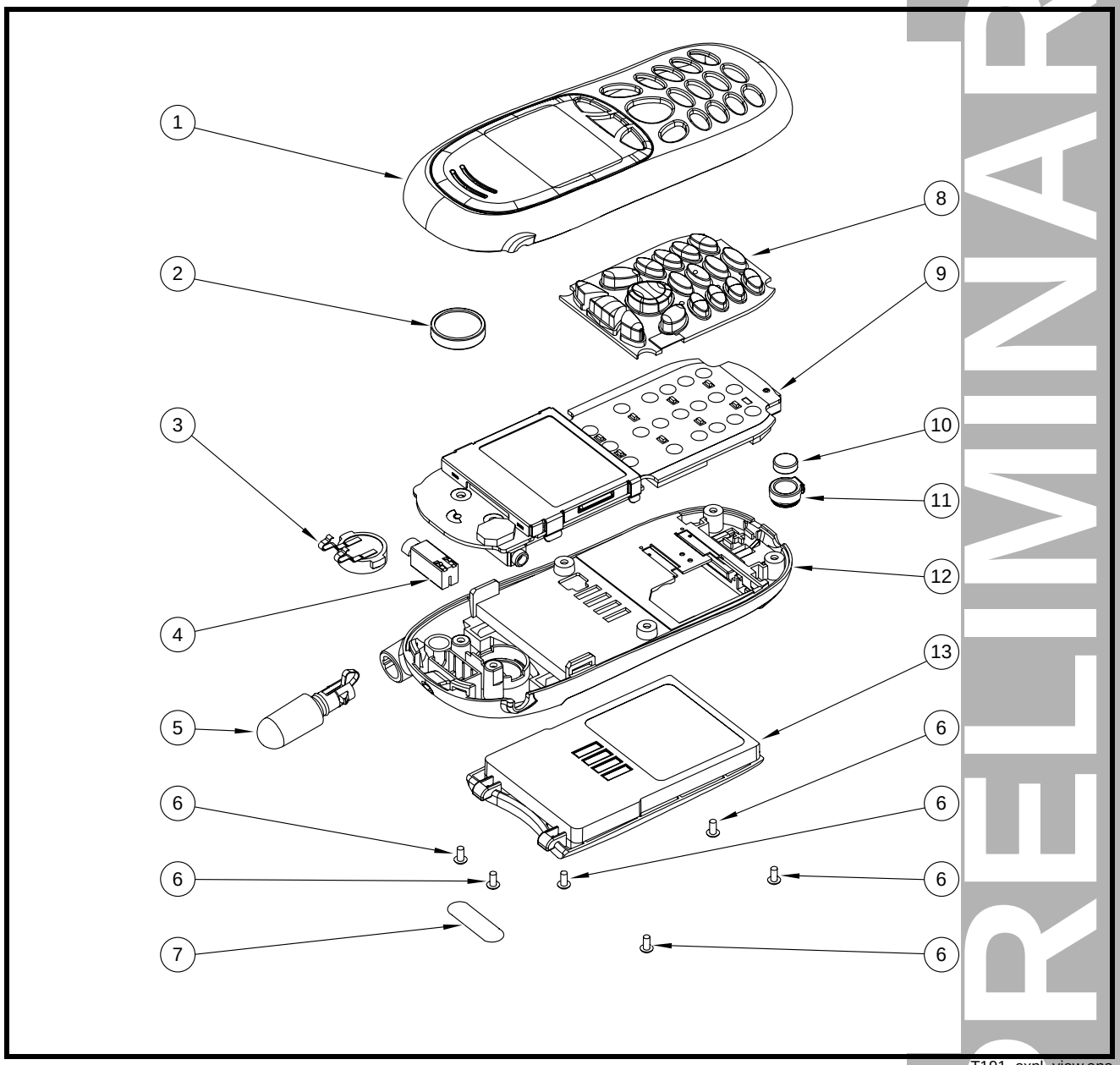



**Figure 22. Exploded View Diagram**

## Exploded View Parts List

**Table 4. Exploded View Parts List**

| Item Number | Part Number | Description |
|---|---|---|
| 1 | see Table 5 | Front housing |
| 2 | 23.40051.011 | Earpiece speaker |
| 3 | 23.60021.001 | Alert transducer |
| 4 | 23.46003.001 | Vibrator Assembly |
| 5 | 25.90020.001 | Antenna |
| 6 | 86.00T03.2P1 | Screw, Torx T5 (6 each) |
| 7 | 1389964L01 | Escutcheon |
| 8 | see Table 5 | Keypad |
| 9 | see Table 5 | Transceiver board assembly |
| 10 | 23.42021.001 | Microphone |
| 11 | 47.G1703.001 | Microphone grommet |
| 12 | see Table 5 | Rear housing |
| 13 | see Table 6 | Battery |
| not shown | 23.20059.001 | RTC battery |

| Item Number | Part Number | Description |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**Notes:** 1. Not available as spares in EMEA Service markets.



*There is a danger of explosion if the Nickel Metal Hydride battery pack is replaced incorrectly. Replace only with the same type of battery or equivalent as recommended by the battery manufacturer. Dispose of used batteries according to the manufacturer's instructions.*

To order parts you can use the following link:

https://wissc.motorola.com/wissc_root/main/BrowserOK.html

A password is required.

For information on ordering parts for EMEA region please call +44 131 479 1274

## Model-dependent Part Numbers

**Table 5. Model-dependent Part Numbers**

| Item Number | Part Description | Part Number |
|---|---|---|
| 1 | Front housing, C25, Frosted Silver | 60.G1703.012 |
| 1 | Front housing, C25, Graphite Gray | 60.G1703.022 |
| 1 | Front housing, C25, Moonstone Blue | 60.G1703.032 |
| 1 | Front housing, C43, Eskimo White | |
| 1 | Front housing, C43, Smoke Gray | |
| 1 | Front housing, C43, Morning Indigo | |
| 12 | Rear housing, C25, Frosted Silver | 60.G1704.002 |
| 12 | Rear housing, C43, | |
| 8 | Keypad English - C25 | 47.G1701.001 |
| 8 | Keypad Traditional Chinese - C25 | 47.G1701.012 |
| 8 | Keypad Simplified Chinese - C25 | 47.G1701.022 |
| 8 | Keypad English - C43 | 42.G2202.001 |
| 8 | Keypad Traditional Chinese - C43 | 42.G2202.012 |
| 8 | Keypad Simplified Chinese - C43 | 42.G2202.022 |
| 9 | PCB Assembly Main Board - C25 | 55.G2201.001 |
| 9 | PCB Assembly Main Board - C43 | 55.G1701.001 |
| - | Transceiver, C25, Graphite Gray S. Asia | SUG2137AA |
| - | Transceiver, C25, Frosted Silver, S. Asia | SUG2138AA |
| - | Transceiver, C25, Moonstone Blue, S. Asia | SUG2139AA |
| - | Transceiver, C25, Graphite Gray, Taiwan | SUG2140AA |
| - | Transceiver, C25, Frosted Silver, Taiwan | SUG2141AA |
| - | Transceiver, C25, Moonstone Blue, Taiwan | SUG2142AA |
| - | Transceiver, C25, Graphite Gray, Hong Kong | SUG2143AA |
| - | Transceiver, C25, Frosted Silver, Hong Kong | SUG2144AA |
| - | Transceiver, C25, Moonstone Blue, Hong Kong | SUG2145AA |
| - | Transceiver, C25, Graphite Gray, PRC | SUG2300AA |
| - | Transceiver, C25, Frosted Silver, PRC | SUG2301AA |
| - | Transceiver, C25, Moonstone Blue, PRC | SUG2302AA |
| - | Transceiver, C25, Frosted Silver, Li-Ion | SUG2386AA |
| - | Transceiver, C25, Moonstone Blue, Li-Ion | SUG2387AA |
| - | Transceiver, C25, Graphite Gray, Li-Ion | SUG2388AA |
| - | Transceiver, C43, Morning Indigo, S. Asia | SUG2303AA |
| - | Transceiver, C43, Eskimo White, S. Asia | SUG2304AA |
| - | Transceiver, C43, Smoke Gray, S. Asia | SUG2305AA |

## Accessories

**Table 6. Accessories**

| Part Description | Part Number |
|---|---|
| Battery, EMEA, 550 mAh NiMH | SNN5626 |
| Battery, S. Asia, 550 mAh NiMH | SNN5623 |
| Battery, S.Asia, 600mAh Li-Ion | SNN5647 |
| Battery, China, 600 mAh Li-Ion | SNN5648 |
| Battery Charger, Hong Kong | SPN4984A |
| Battery Charger, China | SPN4985A |
| Battery Charger, US | SPN4987A |
| Battery Charger, Europe | SPN4989A |
| Battery Charger, UK | SPN4990A |
| Adapter, Euro Plug | SPN4940 |
| Vehicle Power Adapter | SYN7818 |
| Easy-Install Hands Free Car Kit (analog audio) | SYN8597 |
| Headset Ear bud – Silver | AAYN4264A |
| Lanyard | SYN8392 |
| Belt Clip, Black | SYN8631 |
| Pouch, Leather, Black | MOTFL0074K |
| Pouch, Black & Light Grey w/ plastic front | MOTFQ0075M |
| Pouch, Light Blue w/velcro | MOTPT0076M |
| Pouch, Medium Blue | MOTPT0076M |

## Related Publications

| | |
|---|---|
| **Motorola Timeport 191 Wireless Phone User Guide, English** | 9888816L01 |
| **Motorola Timeport 190 Wireless Phone User Guide English** | 9889928L01 |

# Index

## S



## T



## V



## W

Personal Communications Sector,
1500 Gateway Blvd.
Boynton Beach, FL 33426-8292
Printed in U.S.A. 08/01

6881039B15-O

MOTOROLA
Personal Communications Sector

GSM Service Support
Level 3 Authorized

# T190 / T191

GSM Service Support
Training - Documentation - Engineering


# Level 3
# Circuit Description
# 11 / 08 / 01
# V1.0



by Toko (toko@gsm-free.org)

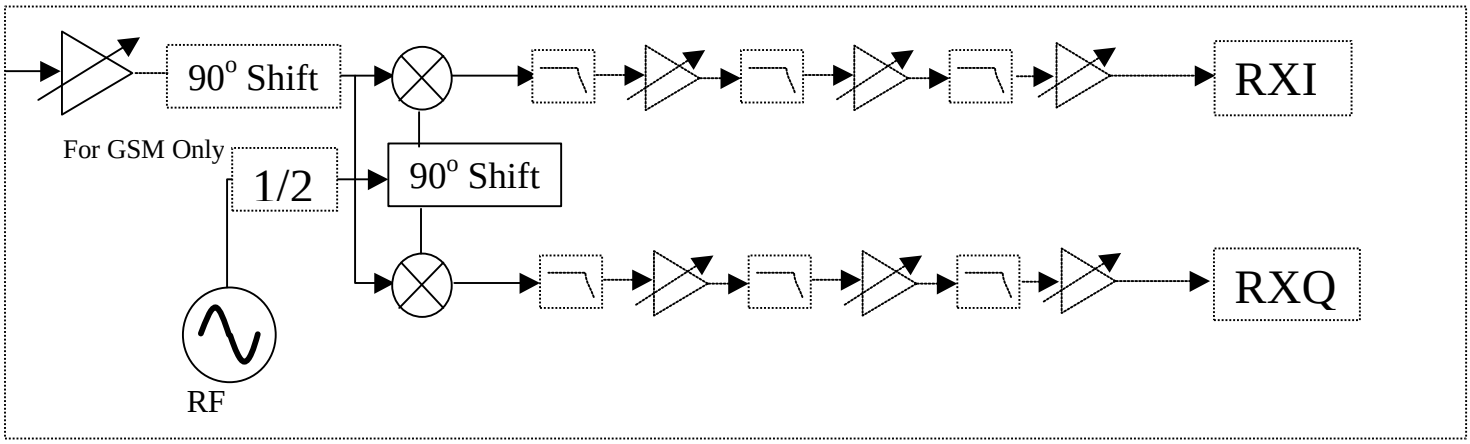
## RECEIVE

1. Received GSM 900 frequency enters the unit at the Antenna ANT1
2. L702 / L701 /C711 provide matching
3. The signal then enters mechanical Auxiliary RF port U72. When a load (50Ω is placed into the socket the RF will be diverted into or out of U72). This socket will be used for phasing, testing purposes.
4. From U72 **Pin 6** to RF Switch U75 **Pin 8** (**ANT**), where through control voltages the Rx path is isolated from the TX path. The following voltages control the RF Switch: **VC1 & VC2**, which are all 0V or 3.6V Low or High respectively.
   **For RX a diplexer is used to separate the GSM and DCS frequencies***
   The controlling input signals for U72 are originated from T/R Switch Controller U73, using the outputs on **Pins 6 & 4**:
   To provide the appropriate switching voltages the following signals are used.
   - **GSM_T/R** this signal puts the phone into GSM Mode when High (originates from Hercules Digital Processor U1 **Pin B10**)
   - **DCS_T/R**, this signal puts the phone into DCS Mode when High (originates from Hercules Digital Processor U1 **Pin E9**)
   - **V_BR**, is the support voltage, it originates from **VBAT** through U90. Voltage range is between 3.3V – 3.6V

   Below are the states of **VC1 & VC2** and the relative states of **DCS_T/R** and **GSM_T/R** for each scenario.

| | **VC1** | **VC2** | DCS_T/R | GSM_T/R |
|---|---|---|---|---|
| GSM RX | 0V | 0V | X | X |
| DCS RX | 0V | 0V | X | X |

5. The appropriate frequency is then fed from the diplexer of U75 from **Pin 10** for GSM and **Pin 1** for DCS
6. The received frequency is then fed into a Dual Band select SAW (Standing Acoustic Wave) filter U66 for GSM (Loss approximately 4dB), and U67 for DCS.
7. The outputs from the SAW filter is 2 balanced outputs that will be fed into the Transceiver IC – U61 on **Pins 4 & 5** for GSM and **Pins 9 & 10** for DCS



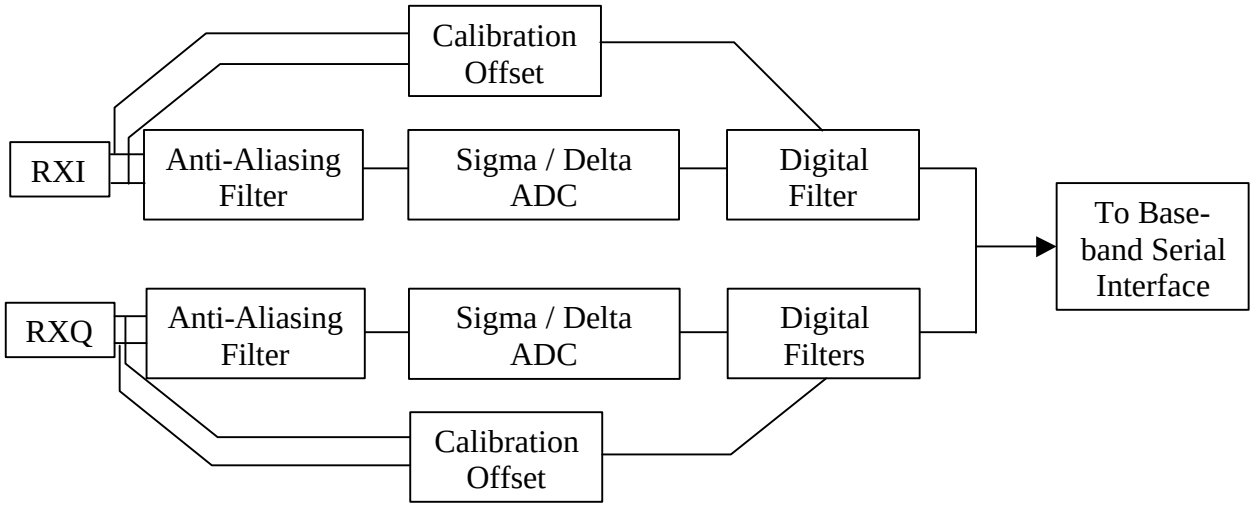

8. U61 is a Dual-Band Transceiver IC; it integrates a direct-conversion receiver vector modulator. (In basic terms Direct conversion allows us to take our incoming frequency and convert that frequency directly to Baseband without the need for expensive IF SAW filters or associated IF components.
9. The signal is firstly passed to an RF Low Noise Amp; this amplifier has 3 variable gain settings that will be programmed via SPI for AGC (Automatic Gain Control) purposes.
   From there the signal is passed in to a pair of Gilbert Cell Mixers, where the received frequency will be mixed with a generated RXVCO reference frequency.
10. The RX VCO frequency is generated by the RF Balun U64, which is fed by the RF Frequency Synthesiser IC, U63, The Charge pump to provide the correct conversion frequency is fed out of the Transceiver IC on **Pin 44**, and is operable between approximately 0.5V and 2.5V dependant on Frequency required. **V_RX** provides the switched supply for U64. This is generated from **V_BAT** through Dual regulator U90, the output on **Pin 1** as **V_SYN**, will then be switched via Q700-2 by **RX_ON_N** to provide **V_RX** at 2.85V
11. The RF signal will then be passed to U64 at 3.6 – 3.84Ghz where the signal will be split into 2 balanced outputs, **Pins 3 & 4**. These outputs will be fed into the Transceiver IC on **Pins 49 & 50** before being fed to the mixers. (The frequency will be divided by 2 for EGSM)
12. Now at Baseband frequencies, the signal will go through a 3-stage amplification process, which has a range of 90dB in 2 dB steps over the 3 amplifiers. The filtering of the Baseband signal is carried out by a first stage R/C Low-pass filter (The capacitor in this filter is external to the IC – C603 and C604).
    This is followed by 2-second stage Butterworth Filters. The IC contains DC offset circuits to remove any unwanted DC values and the signal is fed out as **RXI and RXQ** (Positive and Negative – Still Balanced) on **Pins25 – 28**. These will be passed through a High pass Filter R632

**13.** The Baseband In Phase and Quadrature signals arrive into the Omega IC, U3 on **Pins E7 – E10**, and into the Baseband Codec.

**14.** The Omega IC when combined with Hercules forms a fully integrated DSP. It forms the Base band interface for processing of Voice signals and Base Band signals. It also deals with Supply Voltage Regulation, SIM card, Battery Charging and ON/ Off functionality.

**15.** The Baseband Codec comprises of a Baseband Downlink path, which converts the Baseband Analogue I&Q signals into digital format, where they are filtered through digital FIR to isolate the desired information from the adjacent channels.

**16.** Within the Omega IC the path of the base-band RXI & Q data from the Transceiver IC takes the following route.



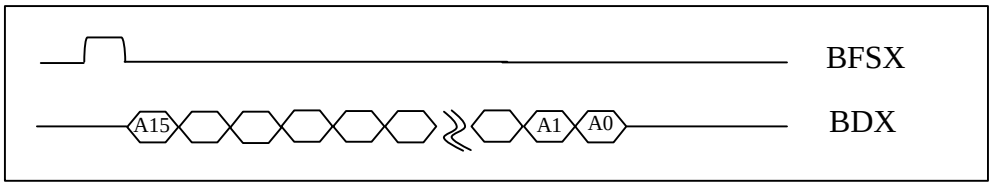

**17.** The RXI and Q signals from the Transceiver IC enter the Omega IC (**BDLIP / BDLIN / BDLQP / BDLQM**) and follow identical paths. The first stage is through a continuous-time second order anti-aliasing filter, which serves 2 functions: 1) to interface between RF logic and on-chip circuitry and 2) to prevent aliasing during the ADC process.

**18.** The signal is then fed into a Sigma – Delta ADC, and is fed out as a 3-bit word. This is then fed into a set of digital filters, that will decimate, (break the signal into piece parts), to give us an overall sampling rate of 270.8KHz (÷24). This allows a low enough frequency for adjacent channel rejection, and therefore channel separation.

**19.** Calibration of the IQ paths is achieved by internally shorting out the 2 input I paths, and then the same again on the 2 input Q paths the digital value measured will then be stored in a register. Once the **RXI** and **Q** paths are reconnected to the circuitry, again the calibration process takes place and the offset value is calculated.

**20.** The digital information is then sent to Hercules via the Baseband serial port on pins on **BDX** (Baseband Data Transmit) and **BFSR** (Baseband Frame Sync Transmit) **Pins G5 & F5** respectively, this information is clocked out at 270Khz.

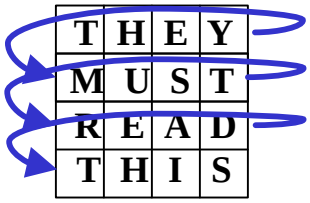
**21.** See below for timing diagram for Transmission of the data.




HERCROM200 (Hercules U1) is a chip implementing the digital Base Band processing of a GSM mobile product.
This chip combines a DSP M16L80 Mega-Module (LEAD2 CPU) with its program and data memories, a Micro-Controller core with emulation facilities (ARM7TDMIE) and an internal 2M bit RAM memory, a clock squarer cell, several compiled single-port or 2-ports RAM.
The chip supports the GSM full-level test approval (FTA) for both Full-Rate, Half-Rate and Enhanced Full-Rate speech coding when using the appropriate GSM protocol stack S/W.
Hercules implements dedicated voice features (voice memo, voice recognition).

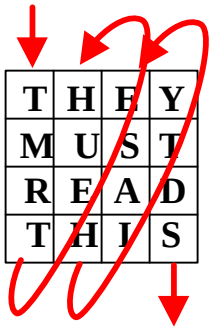
**22.** Within Hercules general GSM processing takes place, such as:

- **De-Interleaving**: Interleaving is a way in which the information that is to be transmitted is jumbled around before it is sent i.e.
  If we wish to send the information 'They must read this'




And we lose the information during the time that 'must' is being sent. Then we will lose a whole word.

- However if we jumble the bits around that make up the words, i.e. transmit in a different order.




If now during the same time frame we lose the same amount of information, and then we will only lose a small part of each word

- **Channel De-Multiplexing** – this is where we decode the signal that was transmitted; encryption at the transmitter ends is usually done by X-ORing the information.

- **Forward Error Correction Decoding** – This is where the redundant bits of data that were added in the transmitter are removed, and the information that is received can be processed. The redundant bits are added in various quantities dependent upon the signal quality. This means if some data is lost whilst travelling OTA then, for example, instead of 8 bits of speech data being lost, only 4 bits of speech and 4 bits of redundant data.

- **De-Segmentation and CRC Attachment analysis**. – During the transmission process the data is broken into packets of various lengths ($N^o$ of bits). These packets are then processed to give a checksum of what should be expected at the receiver. Once in the Hercules the information received is processed, and the two checksums compared. From the analysis, the correct algorithm for repairing any data corruption can be implemented.

**23.** The processed digital audio from the Hercules is then returned to the Omega IC on the Voice-band serial interface **VDR** (Hercules **H12** to Omega **K7**) clock, **VCLKRX** and Frame synchronisation signal, **VFSRX**.

**24.** The processed digital audio is received from the Hercules and fed into the Voice Band Codec of the Omega IC, from here the signal is interpolated within a speech-digital infinite duration impulse response filter (IIR) (i.e. that is, for the data coming in, the adjacent bits of the data being looked at are all synchronised and an average taken. From this a prediction of events can be calculated) also the sampling rate is increased, and the speech bandwidth is limited by high and Low pass responses.

**25.** The signal is then fed into a D/A converter and will be output to the appropriate analogue audio devices. Other functions performed by the Voice band Codec are:
- Programmable Gain for setting Audio Output Levels (Internally set)
- Volume Controls (Externally set gain)
- Side Tone production

**26.** The converted speech can then take 1 of 2 paths.

**27.** Path 1 to the Internal speaker LS1, the audio is fed out of the Omega on **Pins H8 & H9**, and fed directly to the speaker, voltage suppressers T3 and T4 are responsible for ESD protection. The speaker is situated in the front housing of the unit and is connected to the main PCB through an elastomeric contact.

**28.** Path 2 to the Headset Connector, the audio is fed out from the Omega IC on **Pin J9 AUXOP**, from here the audio will be passed to the Headset Socket J3.

**J3 is also used as a serial data entry port for Test / Flashing and Flexing, therefore data switches are required to correctly route the data**.

**29.** The analogue Audio is routed from Omega to an Analogue Switch U8, where a decision will be made to see if Audio or Data (**TXD0**) needs to be selected. This is done using the signal **I03DATA_HP_SEL**. This signal originates from Hercules **Pin M**5. This signal will be a Positive pulse for Data Cable download, that is active Low and will be active high for Earpiece.

For Data Cable  For Earpiece 

**30.** However to originate these control signals, the unit needs to know what is connected, i.e. either Headset or Data cable. This is achieved by using the **EARPHONE_IN** signal to detect the type of accessory. This will provide a voltage of between 2.8V – 2.6V for the Data Cable and 2.4V – 0V for the headset. The signal is fed to the ADC input of the Omega IC **Pin C6**. The signal **I013ACCIN** will detect when an accessory has been plugged into the headset socket and provide a wakeup signal.

**31.** Once the Processor knows what that an earpiece is connected, the Audio will be passed through U8, (supported by **VR2B_SW**, this is **VR2B** passed through a 0O Resistor). Then passed through a Noise Suppressor U9 and into the Headset Socket J3

## TRANSMIT

**32.** There are 2 sources of input audio:

**33.** Auxiliary Microphone is fed from the Headset Connector J3 on **Pin 4**, through Noise Suppressor U9 and into Analogue Switch U10, which will decide if the output will be for **RXD0** (Data Cable) or Analogue Audio. See **Points 30 & 31** for operation. The audio will then be routed to the Omega IC, **Pin H7** as **AUXI**

**34.** The Internal Microphone X2, uses the signal **MICBIAS** to provide correct microphone biasing conditions, the biasing support voltage being fed from the Omega IC, **Pin K9**. Voltage suppressers U14 provides ESD protection to the circuit. The signal is then passed as **MICIP** & **MICIN**

**35.** If both inputs are active then, output signal from the internal microphone will be used.

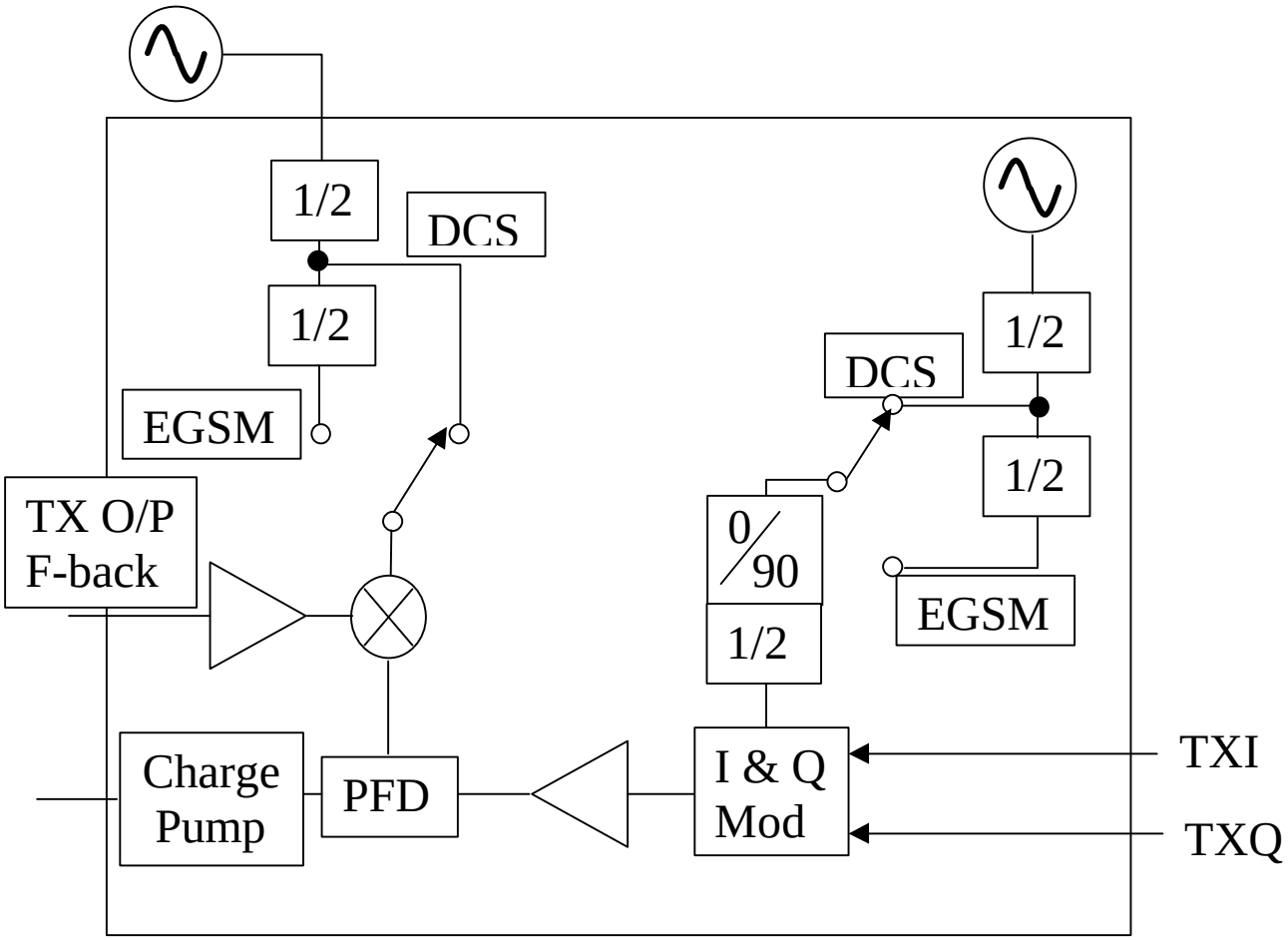
**36.** The input analogue audio is then routed to the Voice Band Codec of the Omega IC **Pins K8 & J8**. Within the Omega IC the analogue signal will be driven through a PGA (Programmable Gain Amplifier), and the information will be passed through an A/D converter.

**37.** Once again, as in **RECEIVE**, the loop between the Omega IC and the Hercules IC is put in place for standard data processing.

**38.** The transmitted signal is sent to the Hercules IC over the Voice-band **VDX** Line Omega **Pin G6** and is clocked by **VCLKRX Pin H6**. The signal is then received by the Hercules IC on **Pins H13 & G11** respectively. Synchronisation is achieved using the frame synch signal **VFSRX** (Omega **Pin G7** / Hercules **Pin H11**.

**39.** After processing, the Base-band signal information is transferred back to the Omega IC using the base-band lines, **BFSR / BDR /** (Omega **Pins J5, K5**and Hercules **Pins F12, F13** respectively)

**40.** Within the Omega IC, the received information will now be passed to the Base Band Codec, where the signals from the DSP will be modulated in accordance with GSM Specifications and will output the analogue **TXI** and **TXQ** signals to the Transceiver IC (Omega **Pins C9 / C10 / D8 / D9**) then through a low pass filter R624/ C621 / C622, entering U61 on **Pins 19 - 22**



**41.** The Transceiver IC U61 generates a modulated signal using a Quadrature Modulator and then converts to the final frequency using an OPLL (Offset Phase Locked Loop.

**42.** OPLL is basically a normal PLL, however it incorporates a down converter mixer, which has the advantage of having a different comparison frequency to that of the transmitted frequency and therefore broadband noise created in the modulator will be outside the spectrum.

**43.** Once generated the modulated word will be superimposed upon the TX IF frequency created by the internal synthesiser. This runs at between 376Mhz and 384Mhz. The signal will then be divided down (by 4 for DCS and 8 for EGSM). This generates signals at 90Mhz for DCS and 45Mhz for EGSM

**44.** The phase-modulated carrier is now forwarded through an amplifier and into the OPLL, the OPLL consists of a Gilbert Cell Down Converter, phase detector, off chip passive loop filter and VCO.

**45.** Within the OPLL, the Feedback from the TX VCO will be fed back into Omega on **Pin 14** and will be mixed (Down Converted) with the RF VCO, which will be divided down by 2 for DCS and 4 for EGSM. This will then be phase compared with the modulated signal to give a difference error signal that when fed into the Charge Pump will create an error voltage that will drive the TX VCO to the correct frequency.

Worked Example.

- Internal TX IF VCO for EGSM = 360Mhz
- Divide / 8 = 45Mhz
- TX Feedback for EGSM = 880.2Mhz
- RF VCO for EGSM = 3700.8Mhz
- Divide / 4 = 925.2
- **RF VCO – TX F/Back = 925.2 – 880.2 = 45Mhz**

**46.** The analogue VCO drive information, is now sent from OMEGA **Pins** 17 to the Passive Loop Filter, consisting of C614 / C615 / C617 & R619 / R621. The charge pump voltage is approximately 0.5V – 2.5V.

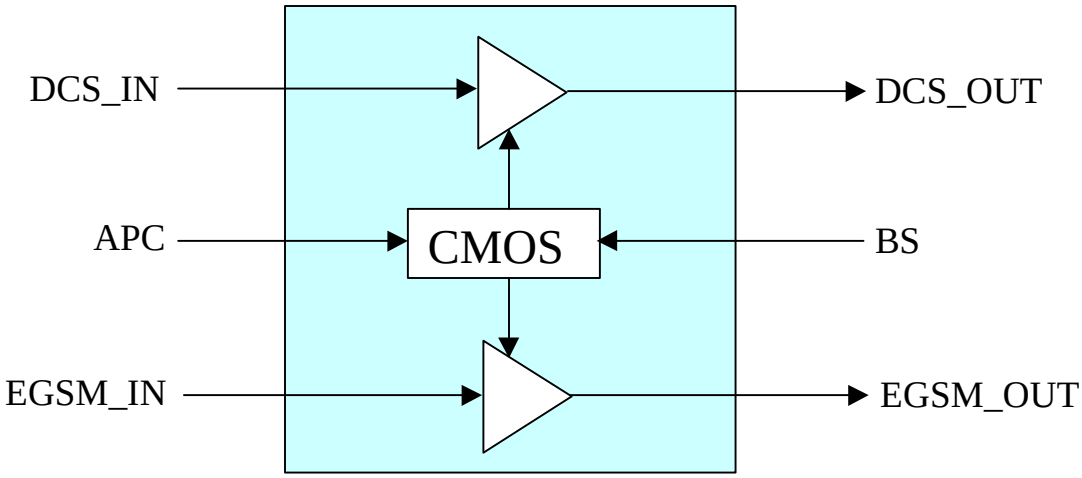
**47.** The charge pump voltage enters the TX VCO on **Pins 10** for GSM and **Pin 6** for DCS. U65 is supported by 2.85V V_TX which is generated by Q700 – 1 (Combination of **V_BR** (U90) and **TX_ON_N**. (**VBAT** switched through U86 by **TX_ON**)

**48.** The control signals **BS1** and **BS2** are used to provide the band switching controls, and are originated from Hercules **Pins B13** & **D11** respectively

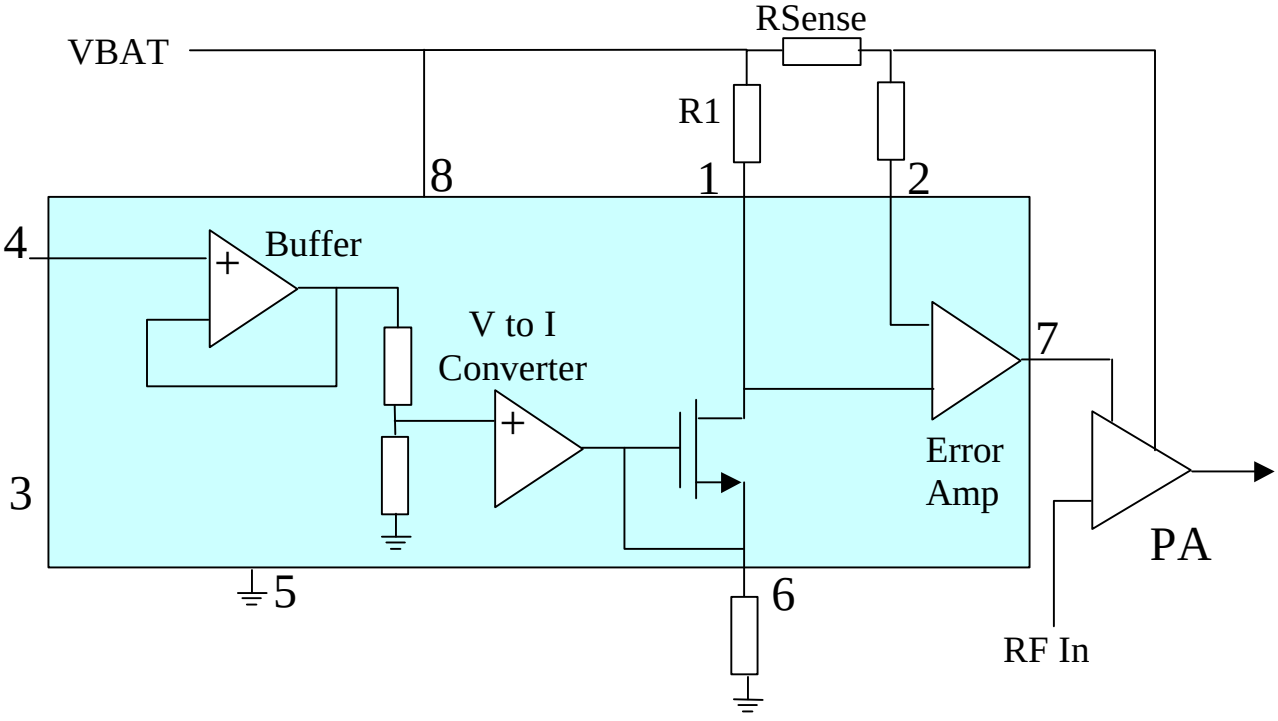
**49.** The appropriate Transmit frequency will now be generated according to channel selection and Band, with the EGSM outputting from U65 **Pin 1** and DCS from **Pin 5**.

**50.** At the output of the TX VCO is a 30dB attenuator to take a sample of the transmitted frequency for use in the Transceiver IC within the OPLL.

**51.** The transmit frequency signal is then pushed to the PA U71 for amplification. U71 is a Dual Band Power Amplifier containing 2 Bipolar Transistor blocks for each band.




**52.** The inputted frequency in inputted into the Transistor stage amplifiers with the signal BS1 controlling the band select. The signal APC (Analogue Power Control) fed in on Pin 6 & 8 (VCC) will allow more or less amplification by providing more or less current to the IC.



**53.** APC is provide by Power Control IC U74
The PAC IC uses a closed Loop bias control voltage system to control the output power of the PA. In normal operation the current driving the PA from **VBAT** will flow through the current sense resistor. When stable the voltage drop across R1 should be = to that across the current sense resistor. The larger the voltage drop over R1, the greater the current delivered to the PA.
When the transmitter needs to deliver more power, the signal **RAMP** from Omega **Pin F9** goes higher. This is fed directly to the U74 **Pin 4** and into the buffer amp; within here the signal is divided by 4 in a ratio of 3:1. The scaled down voltage is now fed to the V to I converter. This switches on the FET allowing a current flow between Pins 1 and Pins 6, therefore setting the R1 Voltage level, and as mentioned previously, the Error Amplifier will output a voltage signal to the PA to drive harder, until R1 and I Sense PD's are the same.
The signal **PC**, from Omega **Pin B12,** acts as an enable.
**VBAT** is switched by **TX_ON** through U86, as a safety feature to remove **VBAT** during receive to ensure no transmission

**54.** The **RAMP** signal is controlled via SPI programming, however a Thermister, TR1 connected to Omega **Pin D6** which is supported by **VR3** feeds temperature information back to the Omega IC, which in turn back down the PA via the **RAMP** signal if the unit is getting too hot.

**55.** Once the transmit power is achieved, the **PA** will transmit in accordance with the GSM Burst specifications. The burst will then be fed through the T/R switch U75, through the mechanical switch U72 and out of the Antenna, ANT 1

**Power up Sequence**

**56.** There are 3 methods by which the product can be switched on, these are:

- On button depressed – On pressing the Power Key (S19) for + 2 seconds, this signal will then be sent to Omega **Pin B10**
- Software wake up – If the user has programmed his unit to wake up at a certain time and Power on, the signal **RTCINT**, will be originated from Hercules **Pin B6** and will be sent to Omega **Pin D7**
- Charger is plugged in – When the charger is plugged in at the Power Jack J1, Power will be sourced from **Pin 1**, through Fuse F1, through U17, and output to Omega **Pin E4**, at a time when **VCHG** > than **VBAT**, Omega **Pin E5**, constitutes the conditions for Power on.

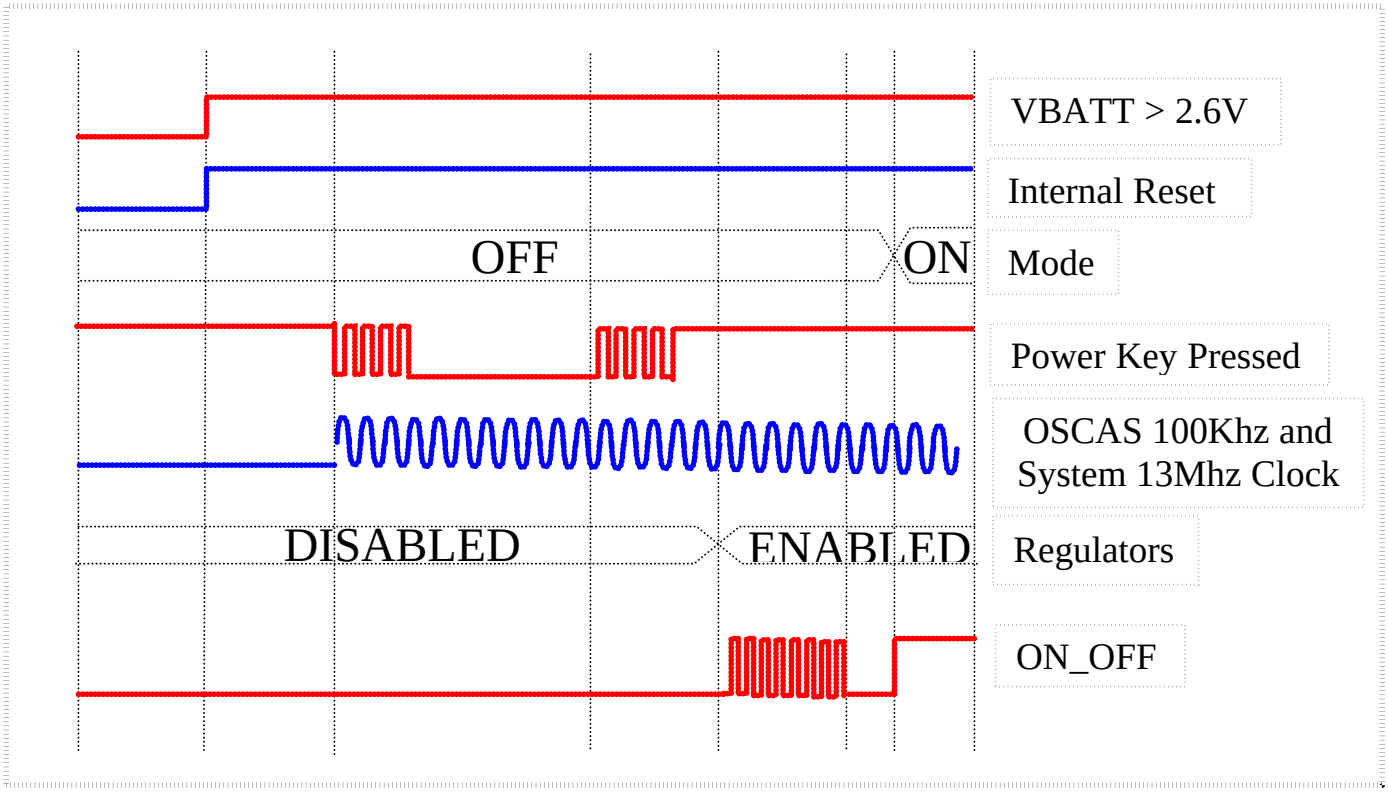
**57.** Once one of the scenarios has taken place, the unit will then begin to power up, the Power up sequence is as follows: (For On/off key pressed)

- Battery power made available from Battery Connector JP1 as **VBAT**, and also a signal is sent to Omega **Pin F1**, as **VBATBB**.

- Power Key, S19 is depressed, which creates an interrupt within the Omega.
- **NRESET** is pulled low, Omega **Pin F6**
- **VREF** and **IBIAS**, set up a reference voltage Band-gap within Omega, using the capacitor and resistor C24 and R23 **Pins F4 and G1** respectively
- This will start the internal 100Khz Internal Clock.
- Regulators now begin to output necessary Voltages, these are:
  - **VR1** – Pin H1 – 1.8V @ 120mA – Supplies Hercules and RTC Battery.
  - **VR2** – Pin E1 – 2.85V @ 120mA – Supplies Hercules 13Mhz Clock Output and Flash and Ext RAM
  - **VR2B** – Pin D1 – 2.85V @ 50mA - Support Omega / Hercules communication and also 3V peripheral devices
  - **VR1B** – Pin C1 – 2.0V @ 50mA – Supplies Omega Internal circuits
  - **VR3** – Pin H10 – 2.85V @ 80mA – Supplies Analogue Voltages

**58.** Once all the necessary voltage have been produced, Hercules will supply the signal **TCXOEN** along with Omega originated **VR3**, this will be fed into RF side U84 and will be used in conjunction with U85 to create the 26Mhz Clock, which is fed into the Transceiver IC **Pin 40**. This is then used as internal system clock within the Transceiver IC, but will also be divided by 2 to create the 13Mhz system clock, Omega Pin 37, Into Hercules **G14**, out on **Pin L14** to Omega **Pin A4.**

**59.** Once all the Power supplies and clock are running, the signal **ON_OFF** from Omega is output to Hercules **Pins D10 / D6**



**Memory**

**60.** The memory consists of a 32Mbit Flash part U5, and a 1Mbit SRAM U6; both are supported by **VR2**. The chip select for the Flash is provided by the signal **NROMCS1** from Hercules **Pin P6** and from **P7** for the SRAM

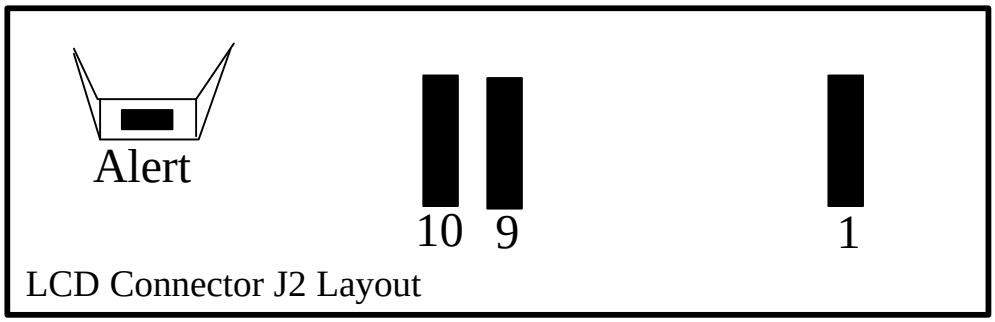
**61.** Contrast control is achieved by the variation in voltages, which are stored in C40 through C44 and DC / DC LCD driving voltages provided by C45 through C48.

**62.** Data to and from the LCD is though the data bus **D0 – D7**, U24 **Pins 16 – 24**

**63.** Chip select is sent from Hercules **Pin 48** to LCD Connector **Pin 28**, with the **Reset** on connector on **Pin 27**.

**LCD**

**64.** The LCD Connector J2 is a 98 X 64 Graphic, Black and White COG (Chip on Glass) type. It uses Serial Data input instead of Parallel data input as Topaz. The LCD Module is supported, with the voltages **VR2** on **Pins 8 & 7**, with 8V being provided by C34. The LCD uses the reset signal from Hercules, **Pin K11**. The data to the display is provided by the SPI bus **I2C_SDA** (data) and **I2C_SCL** (Clock). These are originated from Hercules **Pins C4 and F4** respectively; these are both supported by **VR2B**.



LCD Connector J2 Layout

**Vibrator and Alert**

**65.** The vibrator is driven by the signal **IO0VIBRATOR** which originates from Hercules **Pin J1**, this signal is applied to the base of Transistor BQ4, this then gives the vibrator support voltage **VBAT** a path to earth through Vibrator Motor M1. D14 allows a discharge path for remnant energy after the vibrator has switched off

**66.** The buzzer / alert is operated, using the signal **BU** from Hercules **Pin C2**, this signal can be programmed to variable frequencies. It forces BQ3 to conduct creating the current path for the Buzzer U13 support voltage **VBAT** to earth.

## Keypad and Back lights

**67.** The backlights are split into 2 for the LCD (D4 / D3 / D13) and the keypad backlights of which there are 8 (D5 – D12). The backlights are switched on using the signal **BL** This is generated from Hercules **Pin B1**. When **BL** goes high**,** U7 **Pin 6** goes low, which in turn, forces BQ2 to conduct. This allows **VBATBB** to supply the backlights. Approximately 1.9V will be made available for each set of LED's with approximately 36mA being drawn through R40 and 60mA being drawn through R35

**68.** The keypad is made up of a 4 column x 4 Row matrix, with the signals **KBR3 – KBR0** being generated from Hercules **Pins B2 / D4 / B4 / A4** respectively. The column signals, **KBC4 – KBC1** Hercules **Pin E5 / D5 / B5** / **A5**. Each key has its own unique combination of Column and Row

**69.** The keypad matrix is as follows

| Function | **Key** | **COL 0** | **COL 1** | **COL 2** | **COL 3** | **COL 4** | **ROW 0** | **ROW 1** | **ROW 2** | **ROW 3** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **1** | S3 | X | | | | | | | X | |
| **2** | S2 | X | | | | | | X | | |
| **3** | S1 | X | | | | | X | | | |
| **4** | S7 | | X | | | | | | X | |
| **5** | S6 | | X | | | | | X | | |
| **6** | S5 | | X | | | | X | | | |
| **7** | S10 | | | X | | | | | X | |
| **8** | S9 | | | X | | | | X | | |
| **9** | S12 | | | X | | | X | | | |
| **0** | S13 | | | | X | | | X | | |
| **Down** | S4 | X | | | | | | | | X |
| **SEL** | S8 | | X | | | | | | | X |
| **Up** | S11 | | | X | | | | | | X |
| **#** | S16 | | | | X | | X | | | |
| ***** | S15 | | | | X | | | | X | |
| **Menu** | S15 | | | | X | | | | | X |
| **Send** | S17 | | | | | X | | | X | |
| **Quit** | S18 | | | | | X | | | | X |

## Charger Function

**70.** There are 3 modes of operation for the T191 charge these are:

- Normal charge

- Trigger of Full rate Charge
- Over Voltage Protection

**71. Normal Charge** – During normal operation, once the charger has been plugged into the Power Jack J1, power will be distributed from **Pin 1** and will be passed through Fuse F1.
The signal **ACCID** is not used, instead a resistor is placed on the **ACCID** line to make a potential divider with R75 and this will be used for the Product 'ID' to establish if the unit is from EMEA or ASIA.
Once through the fuse the charging voltage will be fed into **Source 1** of U17, the left side of this dual FET is biased on by the Over Voltage FET U16. The voltage is then fed through to the **Drain**. It will then be fed back into **Source 2** of U17 before being fed out as **VBAT** and **VBATBB**.
During this time the right side of U17 is biased on by the signal **ICTL**, from Omega **Pin E3**, this signal controls the charging profile.

**72. Trigger or Full Rate Charge** – When the battery is completely flat, a quick charge at full current is required, to do this we initially have U18 right side grounded, i.e ON.(this has the effect of fully opening the charge 'gate' of U17)
The right side of U18 is initially 'OFF' as the charging current begins to flow, a biasing voltage will be formed at G2 of U18 ensuring it stays on, at the same time C48 will begin to charge. After 2 seconds, the potential on C47 will be sufficient to switch on U18 left side, this will put a ground onto the **Gate** of U18 Right side, which will turn this side off, thus allowing the controlling signal **ICTL** to take control of the charging current.

**73. Over Voltage Mode** – The Over Voltage Mode is set at a threshold of 7.8V, if the voltage on the Charge input line should exceed this then the voltage between R62 & R65 will go above 0.73V and will switch the left side of OVIC U16 'ON' the will provide a path to Earth, grounding the inputted Charger Voltage.

**SIM Circuit**

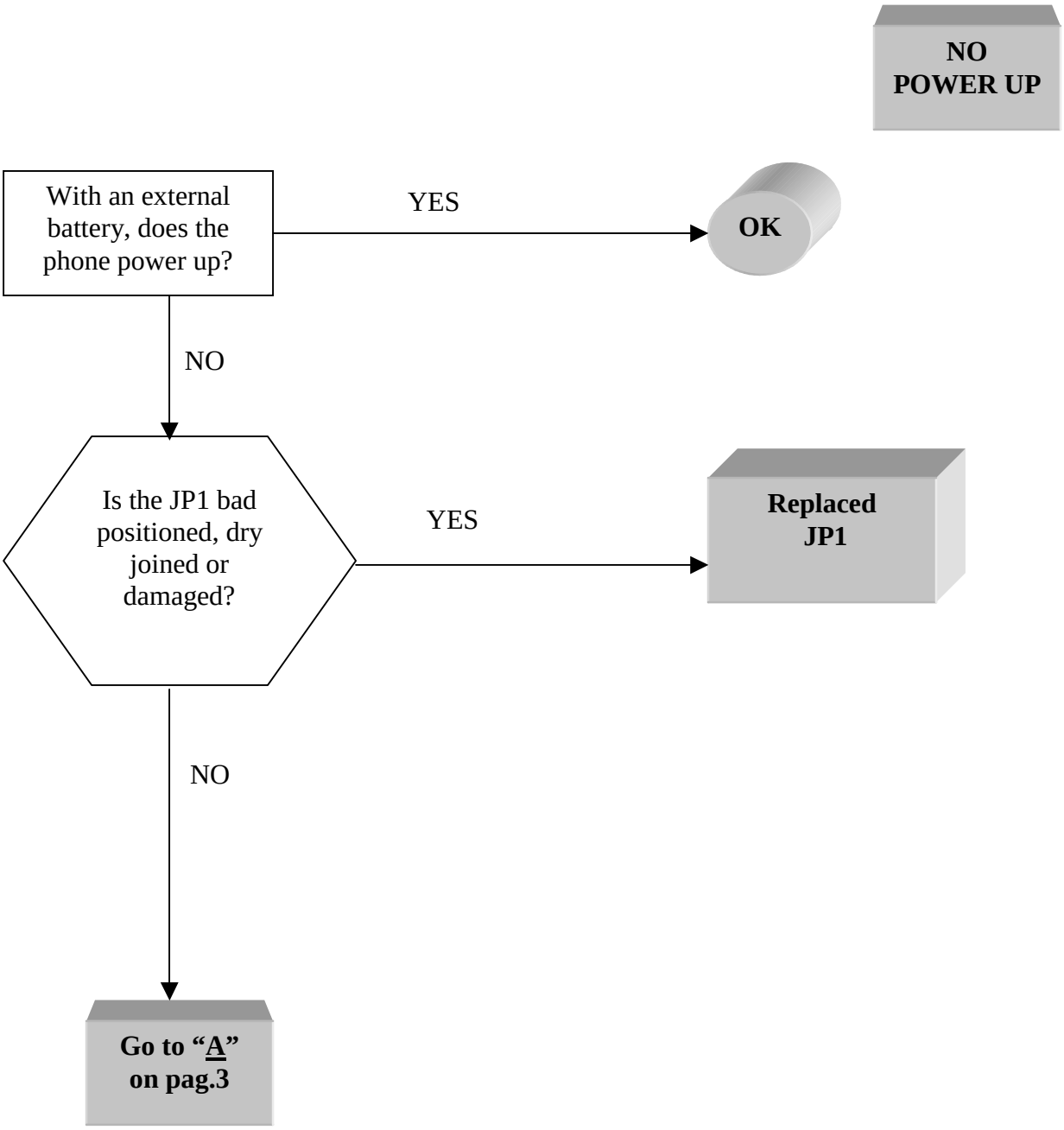
**74.** Both 3 and 5V SIM cards are supported by the Omega. The 5V is achieved by using a charge pump circuit, consisting of C5 and C6, along with the 2.85V **SVDD** (Omega **Pin A2**). This will be fed onto the SIM Block U2 on **Pins 4 and 5**.

**75.** Other signals are:

- **Reset**, Omega **Pin D5**, U2 **Pin 3**
- **Clock**, Omega **Pin B4**, U2 **Pin 1**
- **I/O** (data to and from the SIM Card) Omega **Pin D4**, U2 **Pin 2**, again this can be transposed from 3V to 5V if necessary)

# Level 3 Debug Guide
# by Toko (toko@gsm-free.org)

**Summary**:


NO
POWER UP
With an external battery, does the phone power up?
YES
OK
NO
Is the JP1 bad positioned, dry joined or damaged?
YES
Replaced JP1
NO
Go to "A" on pag.3

**NO POWER UP**

**"A"**

Use a external power supply. Then, press the power-on key, ¿the consumption is 100 mA?

NO

**Go to "B" on pag. 5**

YES

Measure de waveform of R56, ¿is the clock´s signal of 32KHz present?

YES

Measure de waveform of R2, ¿is the clock´s signal of 13KHz present?

YES

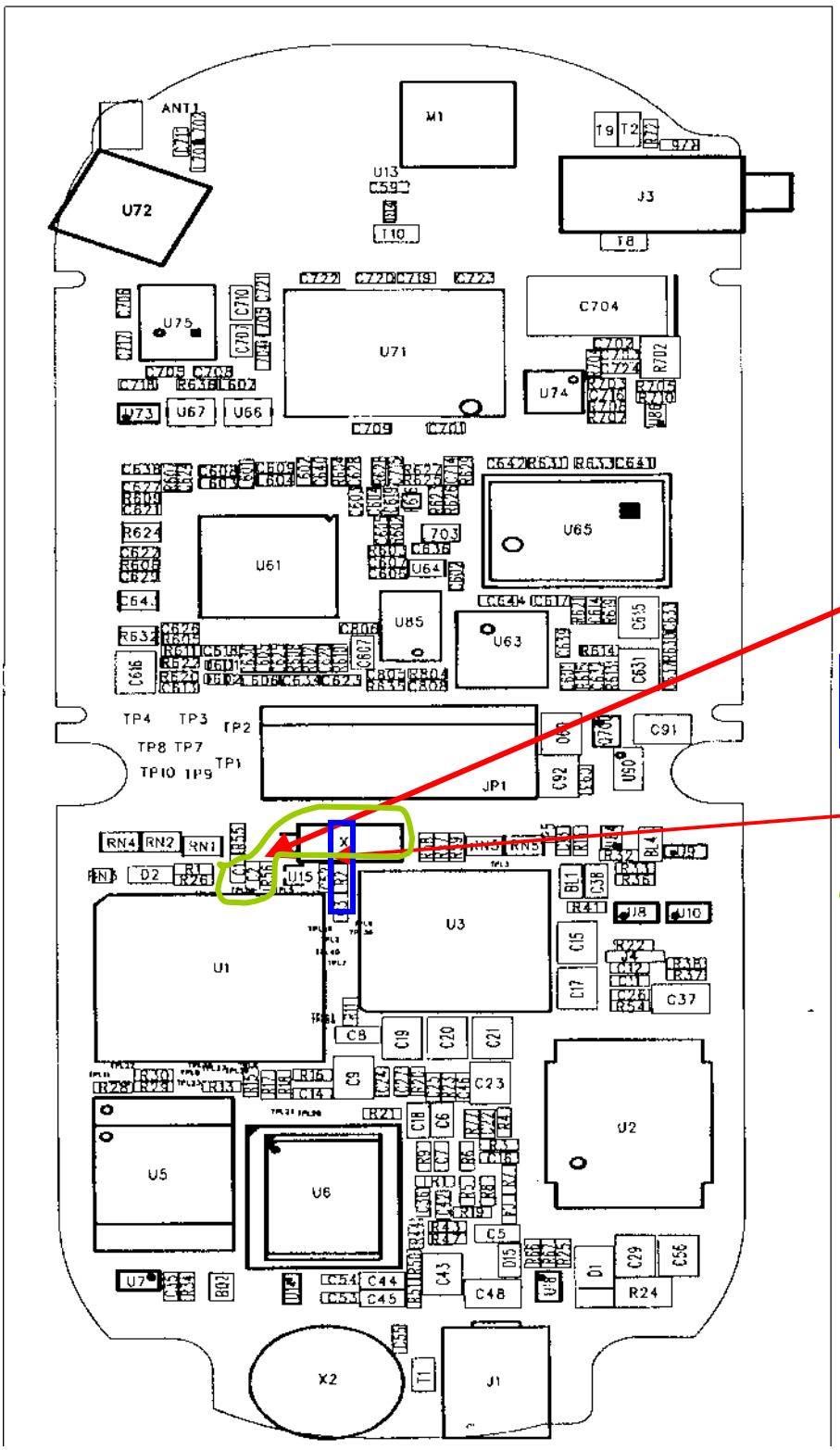
NO

**Replace C3 y R2**

NO

**Replace X1, R56, C1 y C2**

NO POWER UP


ANT1
M1
U13
J3
U72
U75
U71
C704
U74
U73
U67
U66
U65
U61
U64
U85
U63
TP4
TP3
TP2
TP8
TP7
TP1
TP10
TP9
JP1
C91
RN4
RN2
RN1
X
U15
U3
U1
U10
C37
C8
C19
C20
C21
C23
U2
U5
U6
C5
C44
C45
C48
R24
X2
J1
32 MHz
C3, R2
13MHz
X1,R56
C1,C2

**"B"**
**From pag.3**

**NO POWER UP**

If the current is below 100mA, check the volts component:
on R15, VR1=1.8v
on R17, VR2=2.9v
on R16, VR2B=2.9v
on R32, VR3=2.9v
are all OK?

NO → **replace U3**

YES

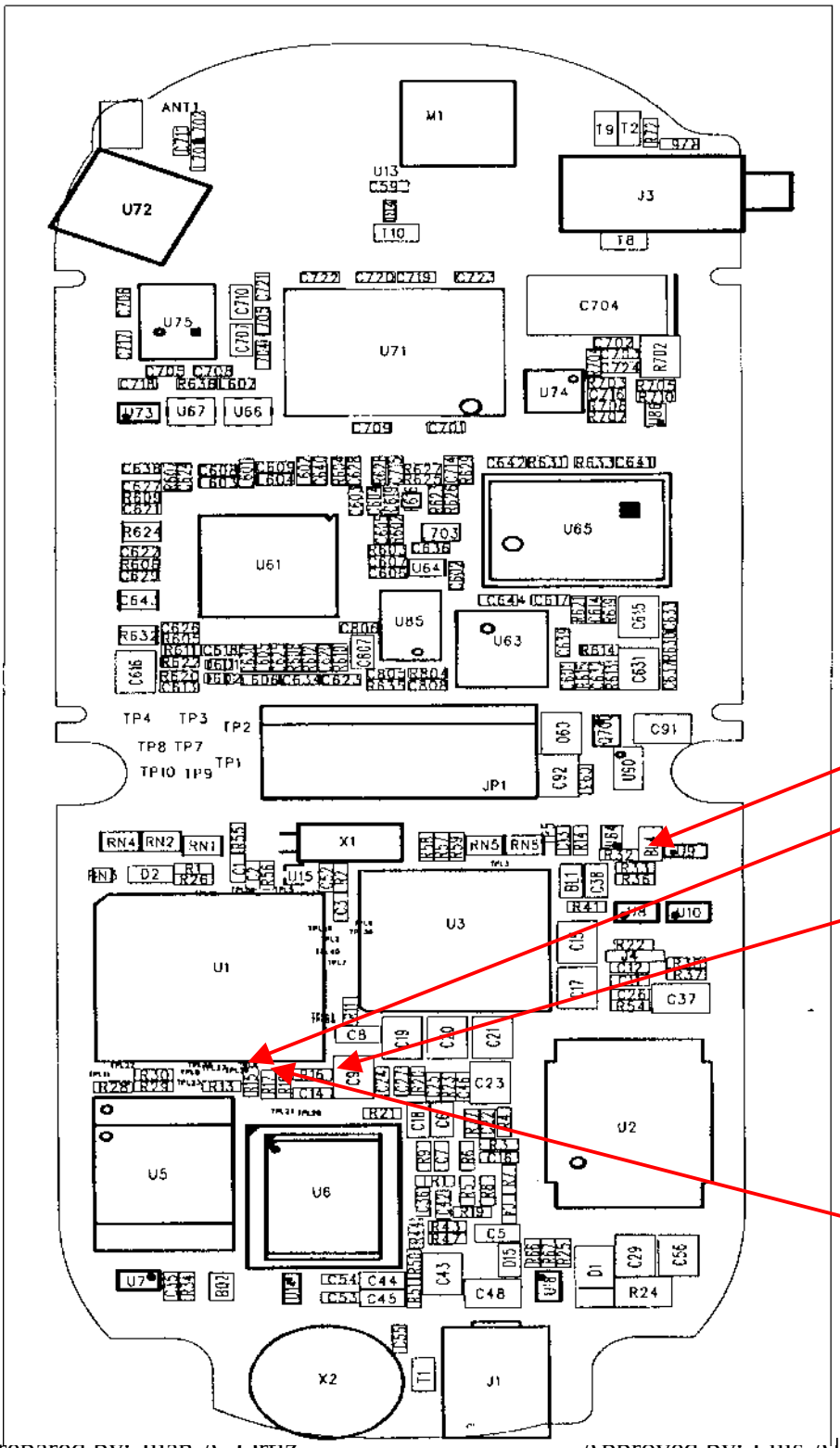
Measure in TPL21 and TPL23, Are there information?

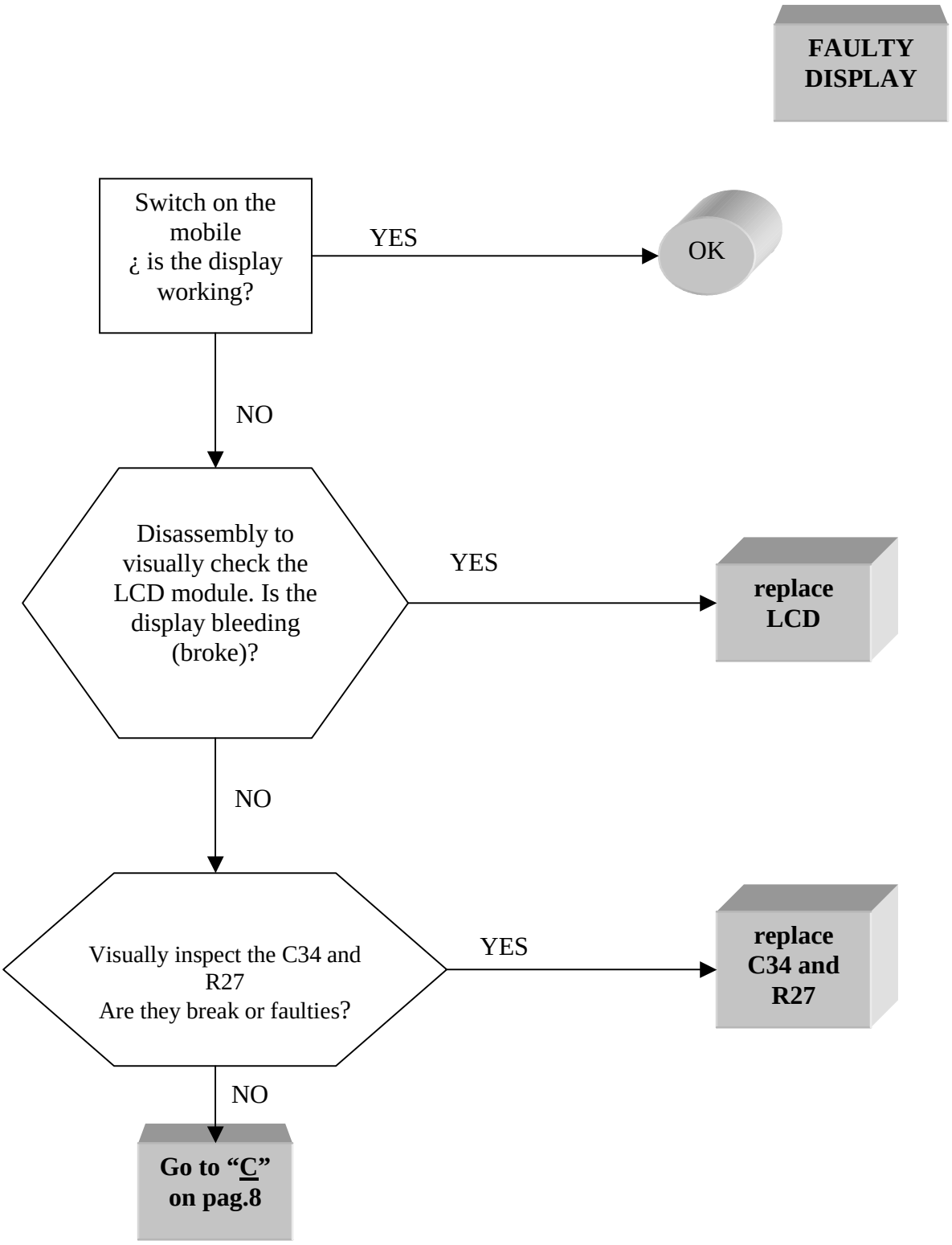
NO → **replace U5**

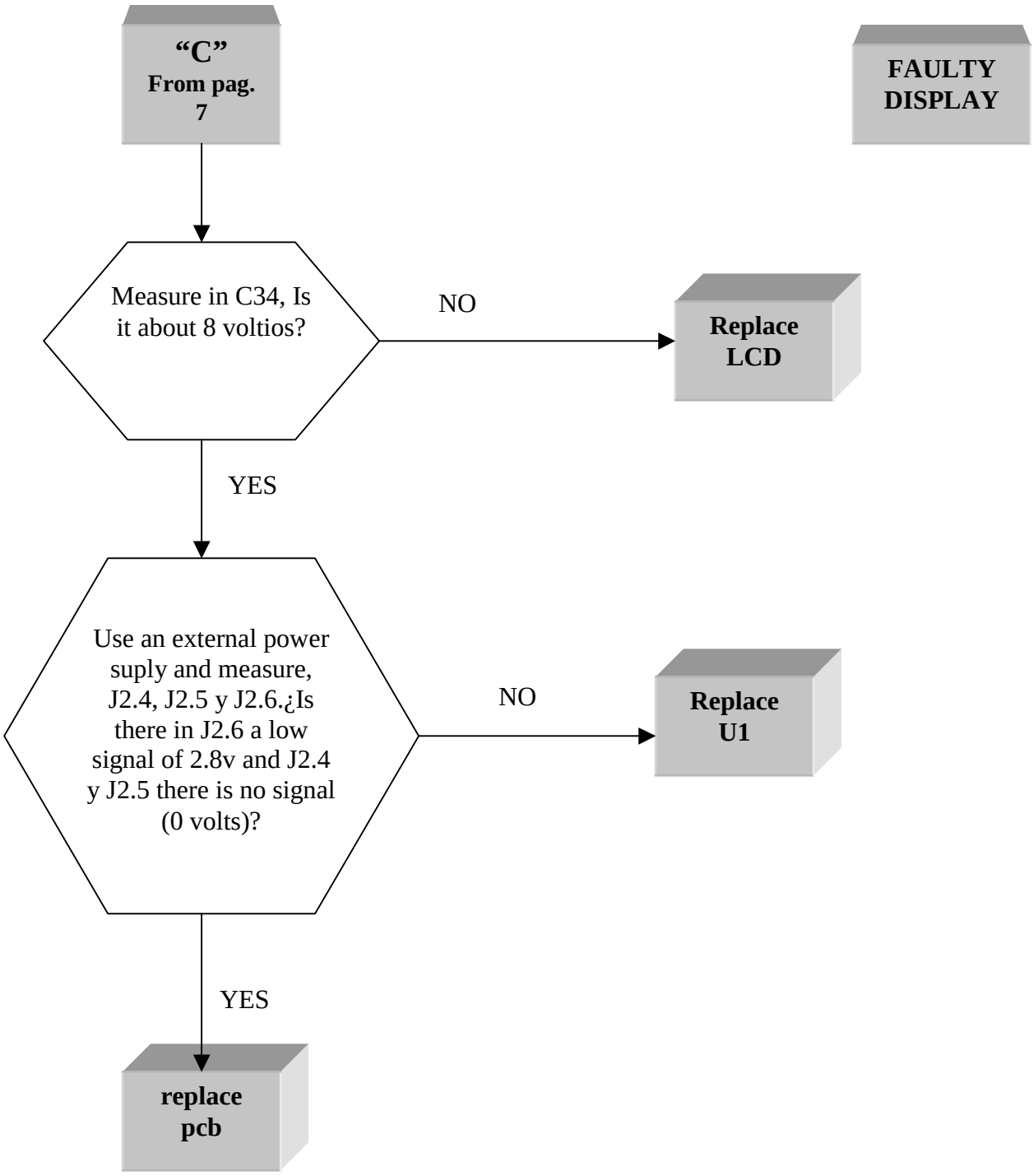
YES

**replace pcb**

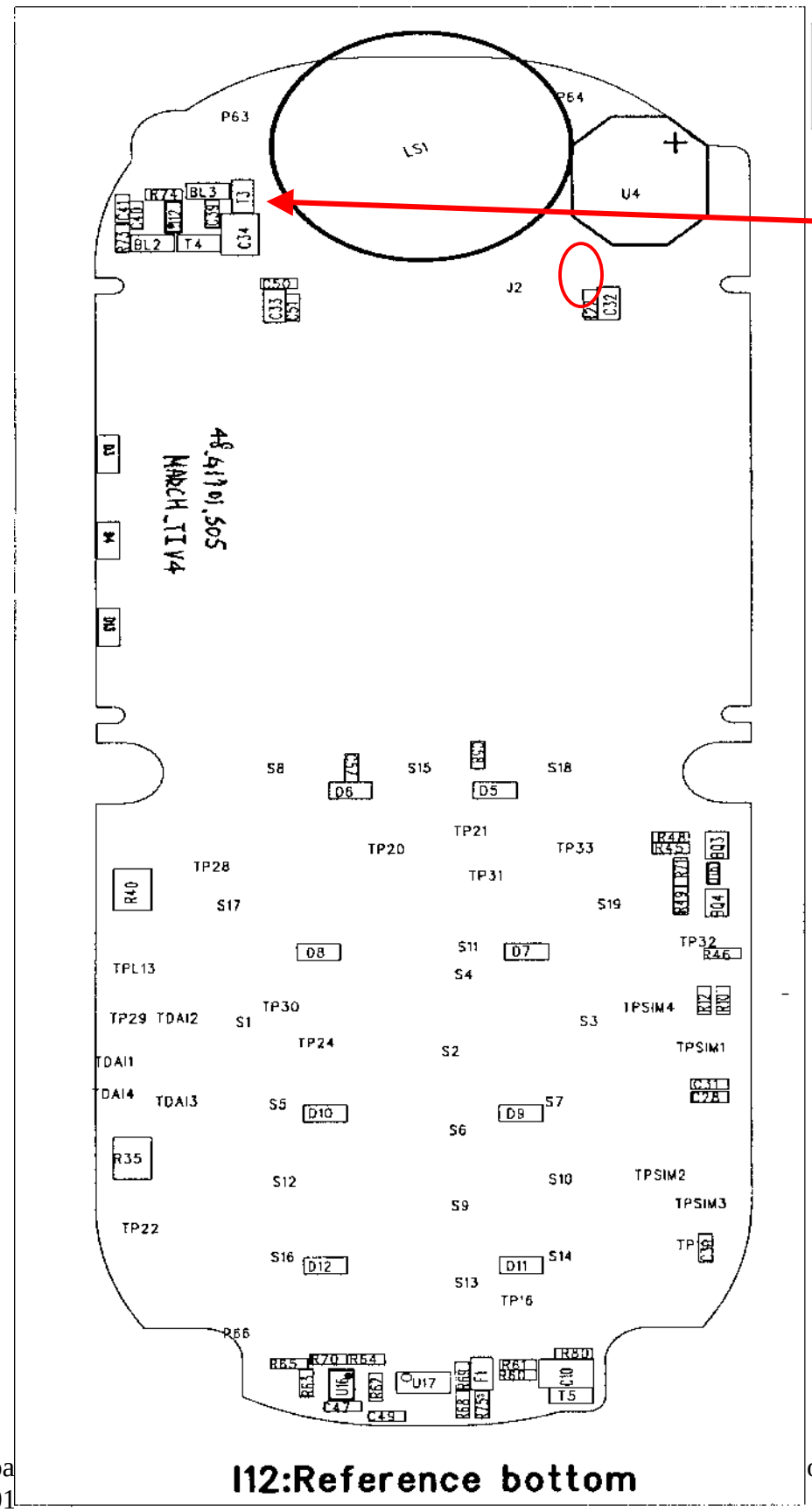
NO POWER UP

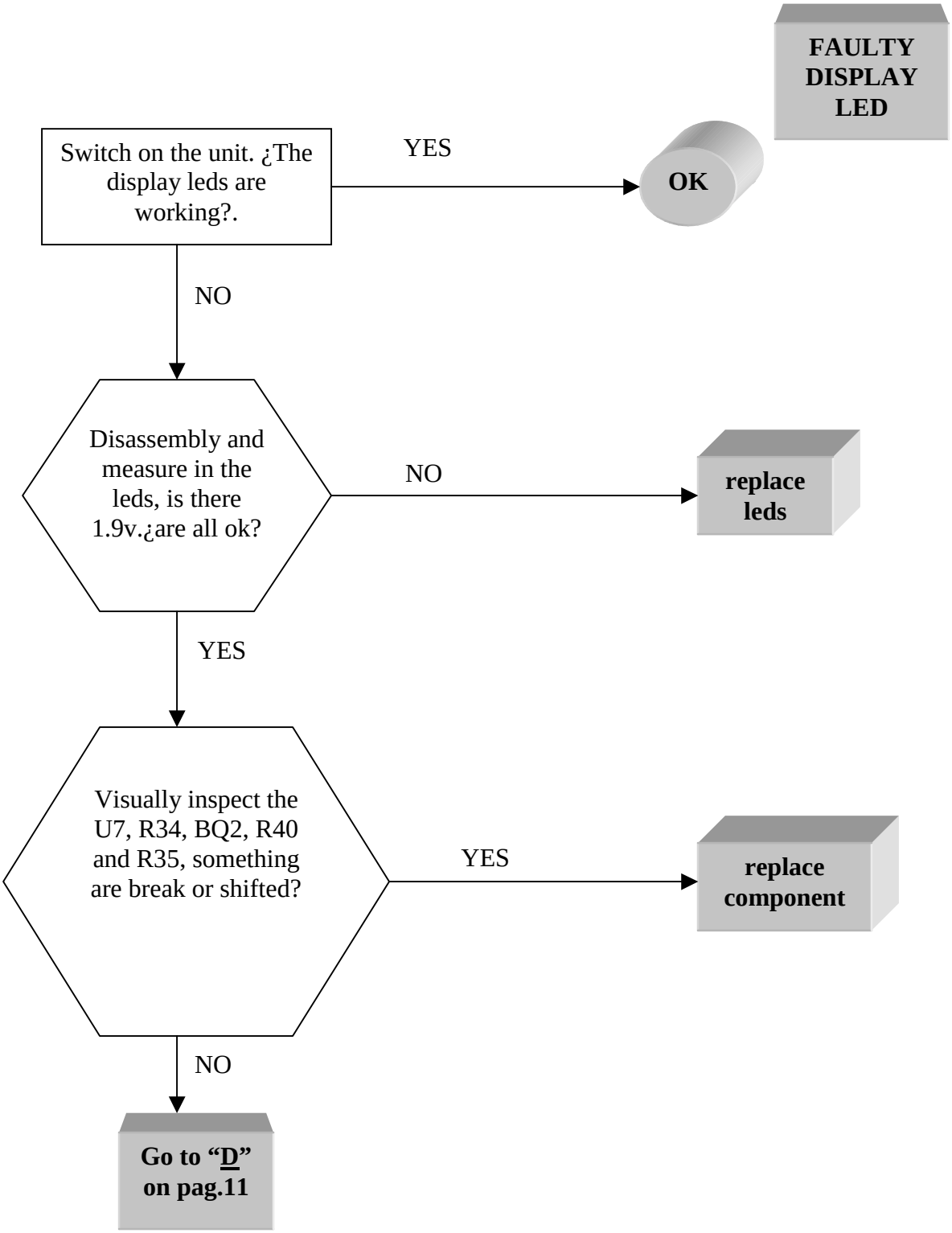

ANT1
M1
U72
U13
J3
U75
U71
C704
U74
U67
U66
U61
U65
U64
U85
U63
TP4
TP3
TP2
TP8
TP7
TP10
TP9
TP1
JP1
C91
X1
U3
U1
U10
C37
C8
C23
U2
U5
U6
C5
C44
C45
C48
C29
C56
R24
X2
J1
R32,VR3=2.9v
R15,VR1=1.8v
R16,VR2B=2.9v
R17,VR2=2.9v


FAULTY DISPLAY
Switch on the mobile ¿ is the display working?
YES
OK
NO
Disassembly to visually check the LCD module. Is the display bleeding (broke)?
YES
replace LCD
NO
Visually inspect the C34 and R27 Are they break or faulties?
YES
replace C34 and R27
NO
Go to "C" on pag.8


"C"
From pag. 7
FAULTY DISPLAY
Measure in C34, Is it about 8 voltios?
NO
Replace LCD
YES
Use an external power suply and measure, J2.4, J2.5 y J2.6.¿Is there in J2.6 a low signal of 2.8v and J2.4 y J2.5 there is no signal (0 volts)?
NO
Replace U1
YES
replace pcb

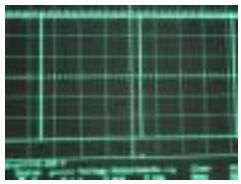
FAULTY DISPLAY




FAULTY DISPLAY LED
Switch on the unit. ¿The display leds are working?.
YES
OK
NO
Disassembly and measure in the leds, is there 1.9v.¿are all ok?
NO
replace leds
YES
Visually inspect the U7, R34, BQ2, R40 and R35, something are break or shifted?
YES
replace component
NO
Go to "D" on pag.11

**"D"**
**From pag.10**

**FAULTY LED**



Measure in the output of U7.2, when the led is on. Is there any signal?

NO → **replace U1**

YES

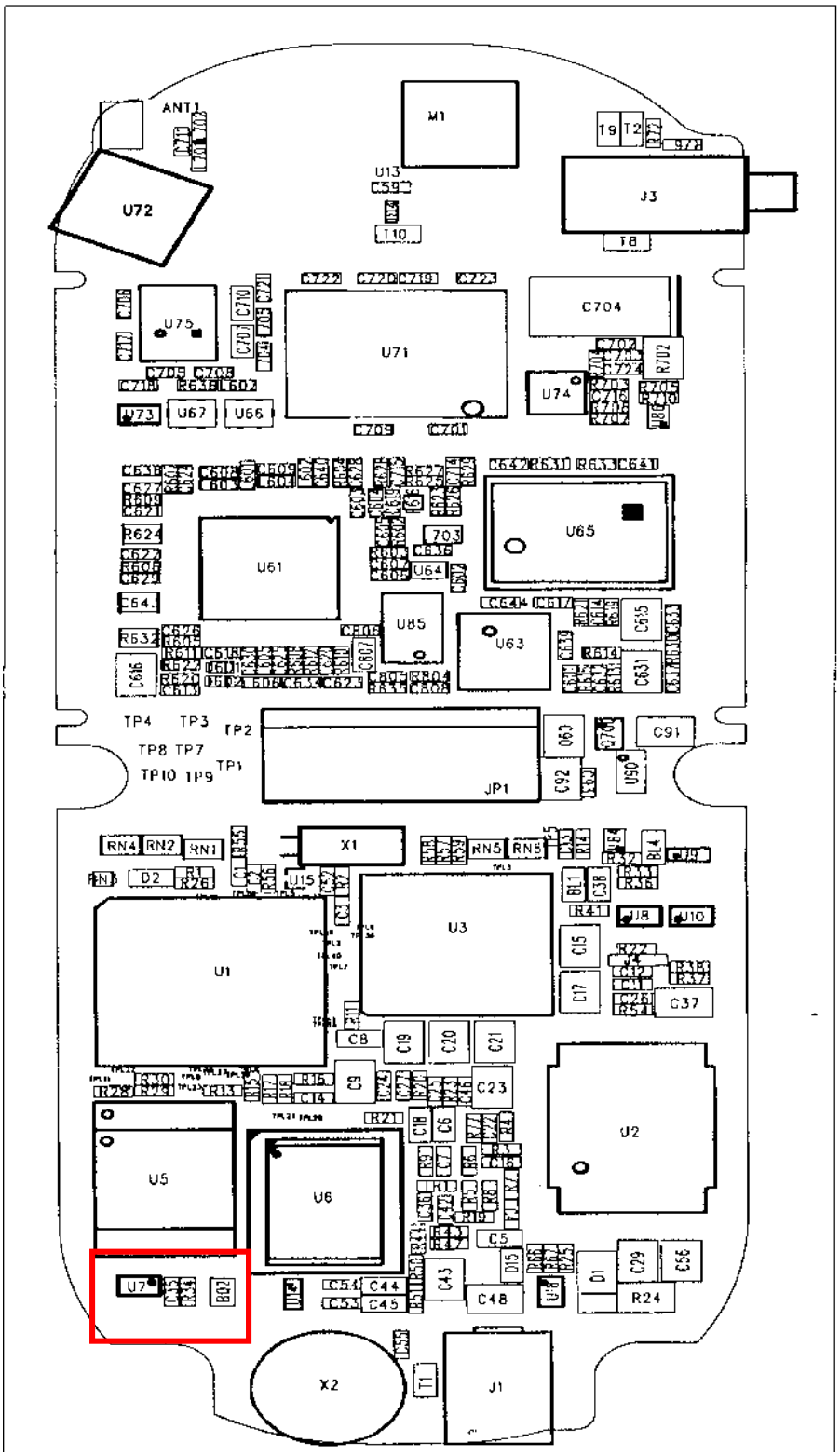
Measure in the output of U7.6, in BQ2.2 and BQ2.3 when the led is switch on, there is signal?

NO → **replace component**

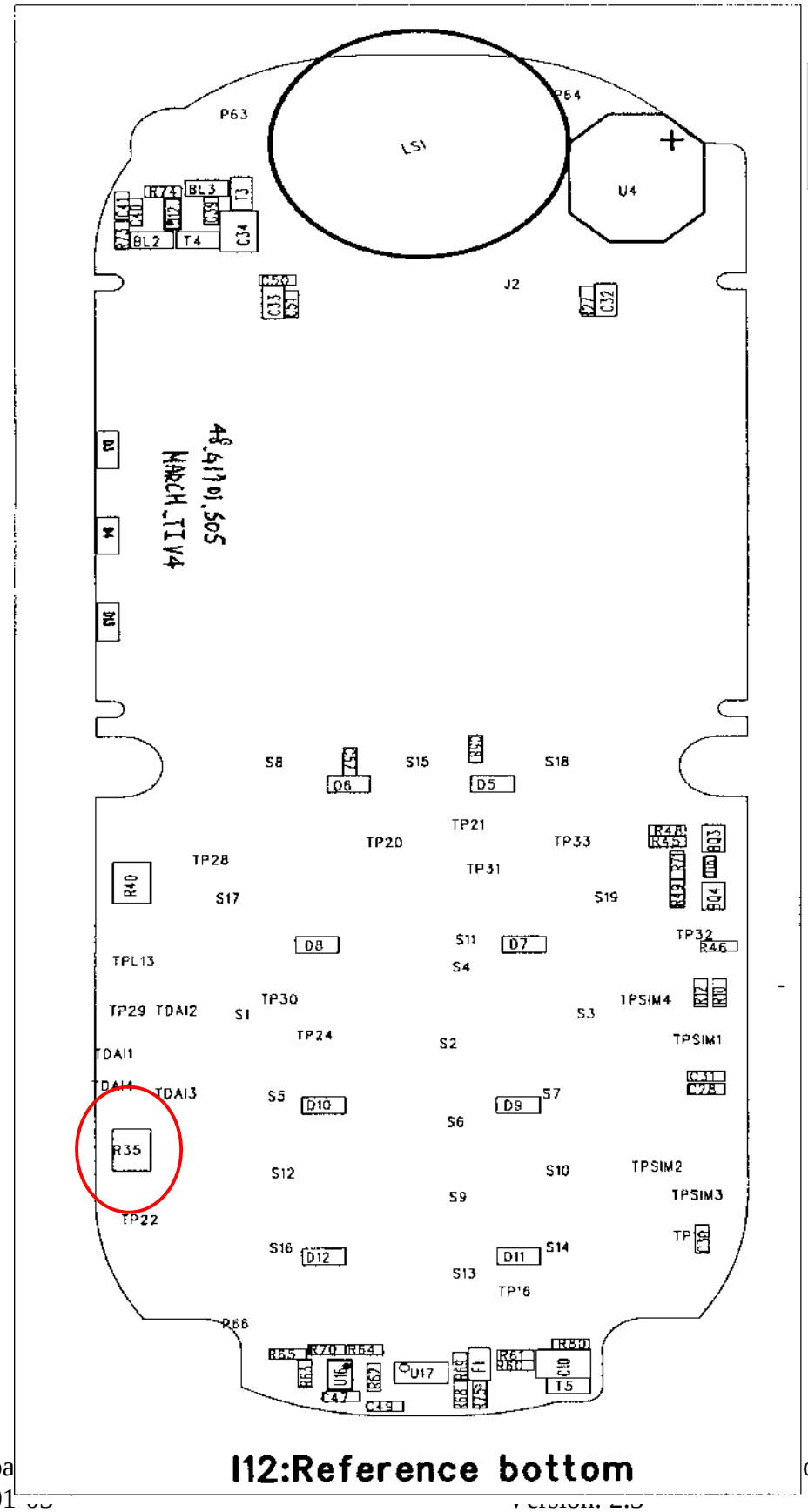
YES

**replace pcb**

FAULTY DISPLAY LED



FAULTY DISPLAY LED




I12:Reference bottom

FAULTY RINGER

Swicth on the mobile, check the ringer, is it working?

YES → OK

NO

Disassembly ti inspect visually the R48, BQ3, R45 and R71, there are shifted something component?

YES → replace the component

NO

When buzzer function is executed, measure the signal in the D16.1, is it ok?

NO →  → replace U1

YES

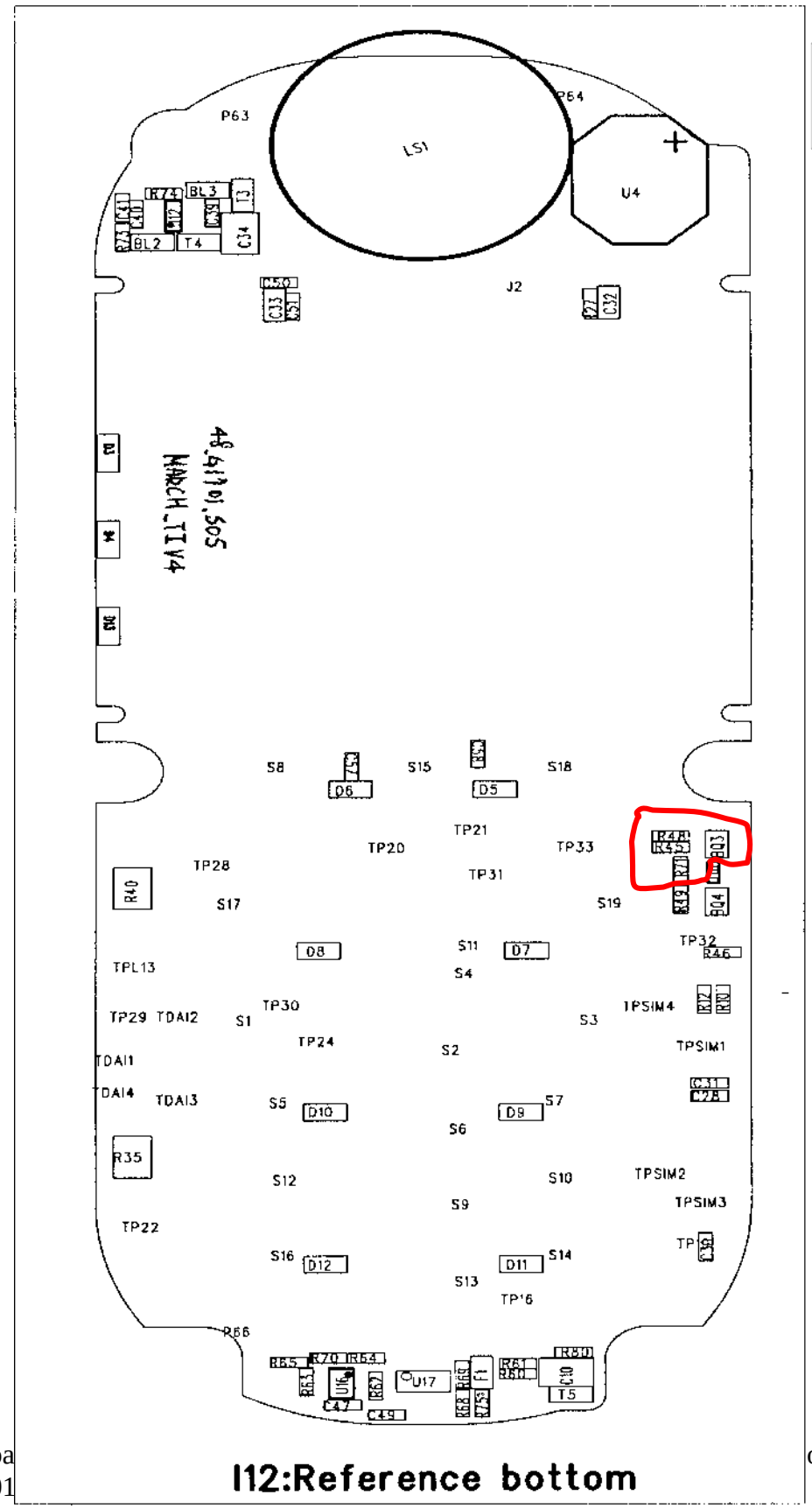
When the buzzer function is executed, are there signals of 0.5v in BQ3.3, BQ3.2 y BQ3.1?

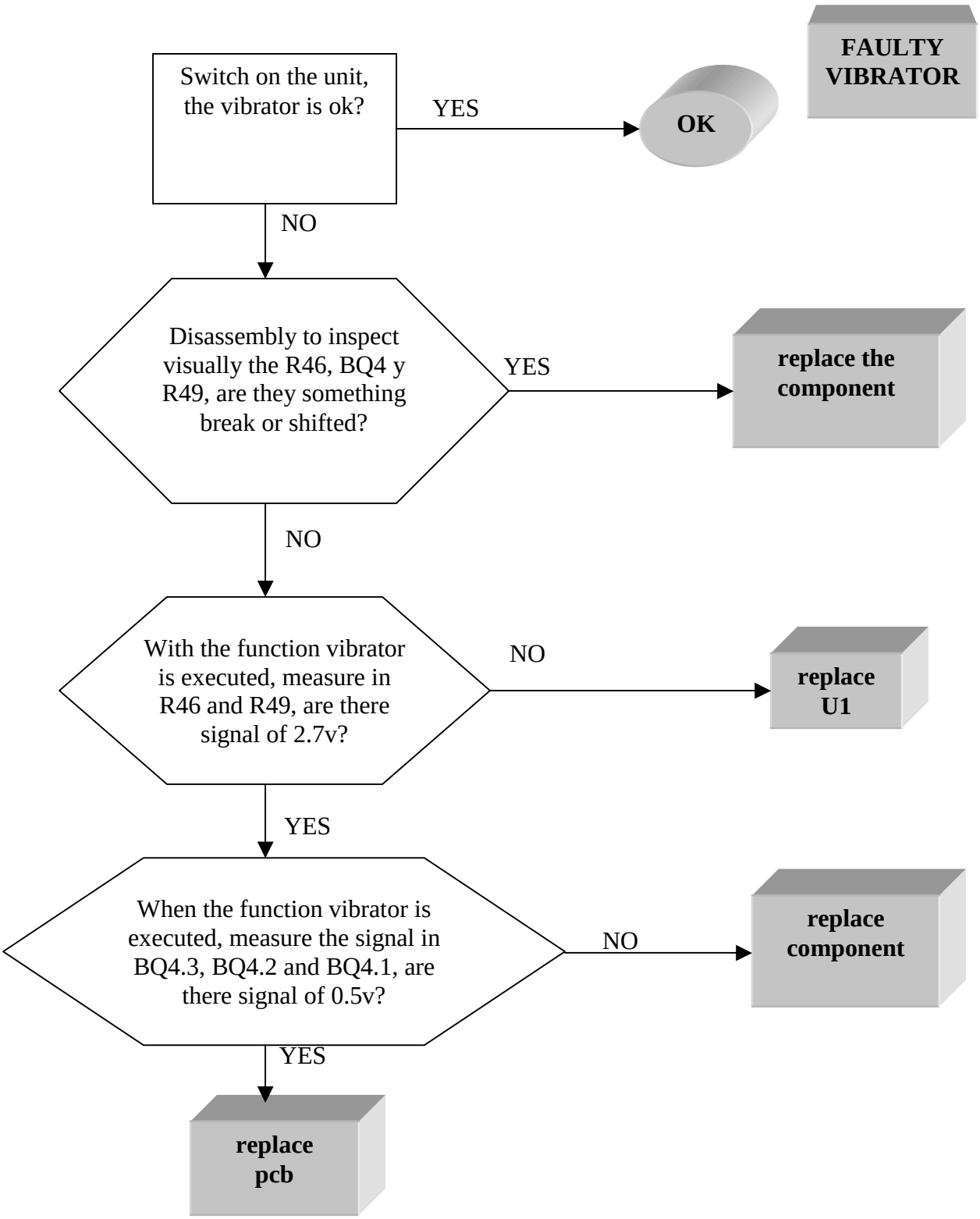
NO → replace component

YES

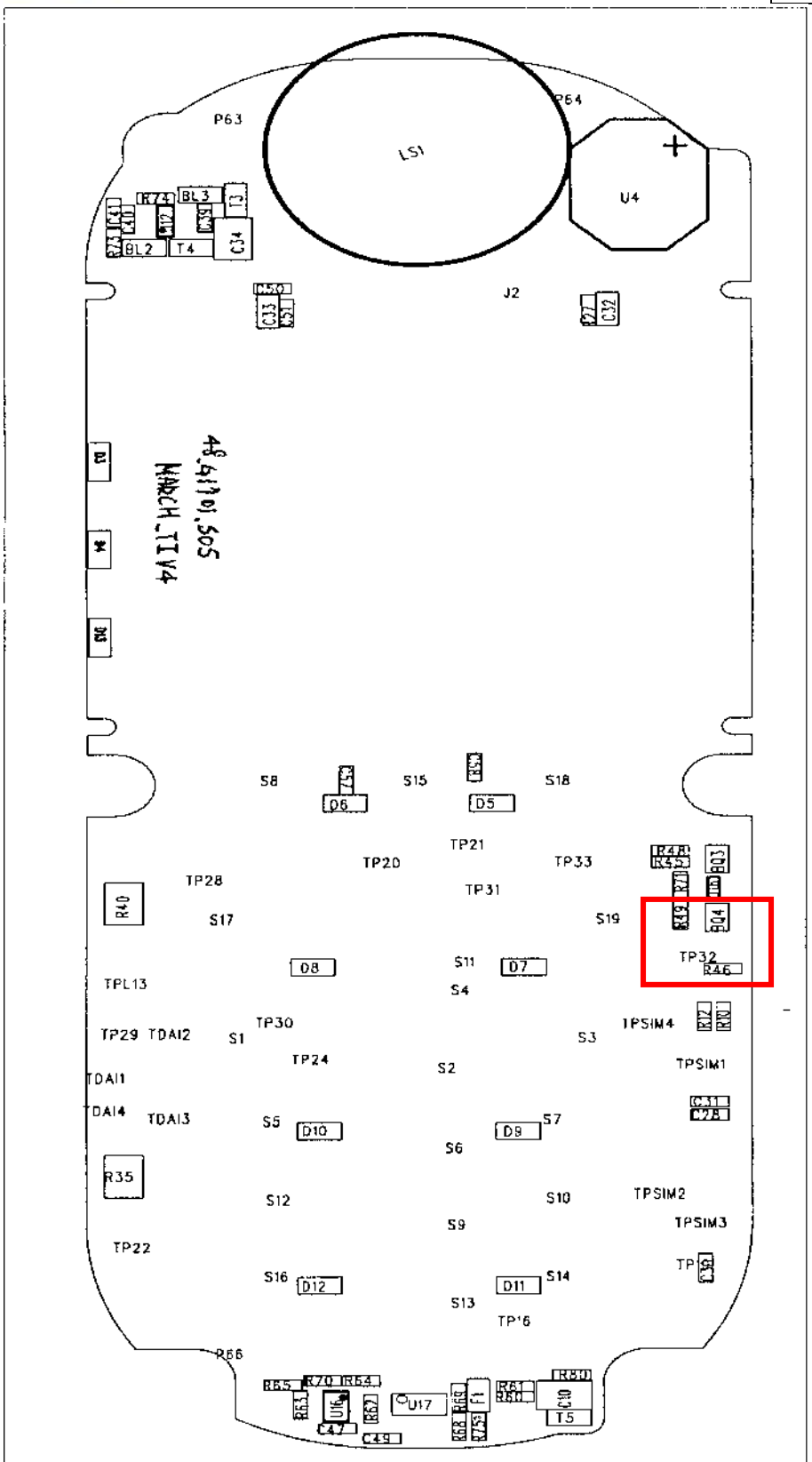
replace pcb

FAULTY RINGER

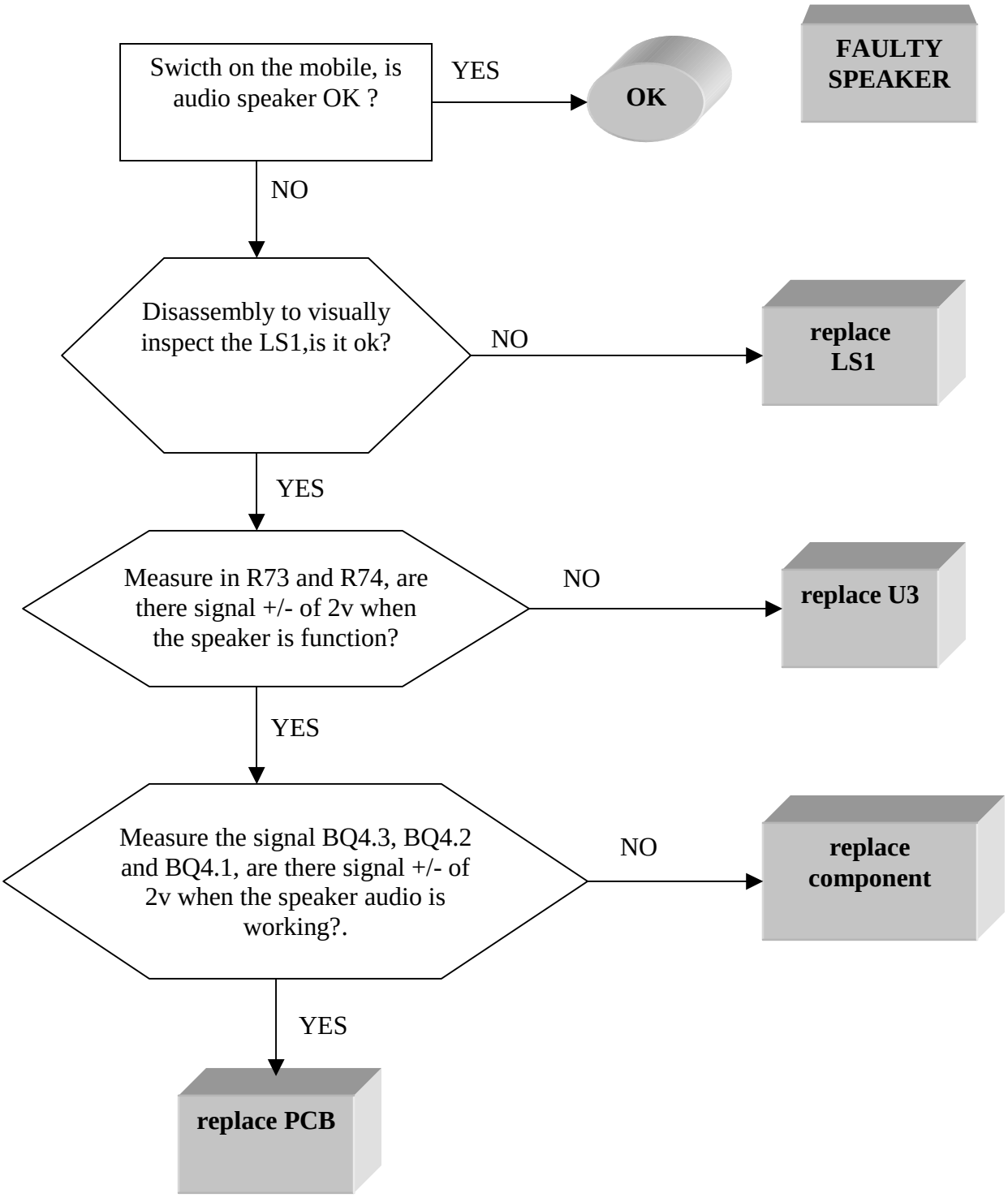



Switch on the unit, the vibrator is ok?
YES
OK
FAULTY VIBRATOR
NO
Disassembly to inspect visually the R46, BQ4 y R49, are they something break or shifted?
YES
replace the component
NO
With the function vibrator is executed, measure in R46 and R49, are there signal of 2.7v?
NO
replace U1
YES
When the function vibrator is executed, measure the signal in BQ4.3, BQ4.2 and BQ4.1, are there signal of 0.5v?
NO
replace component
YES
replace pcb

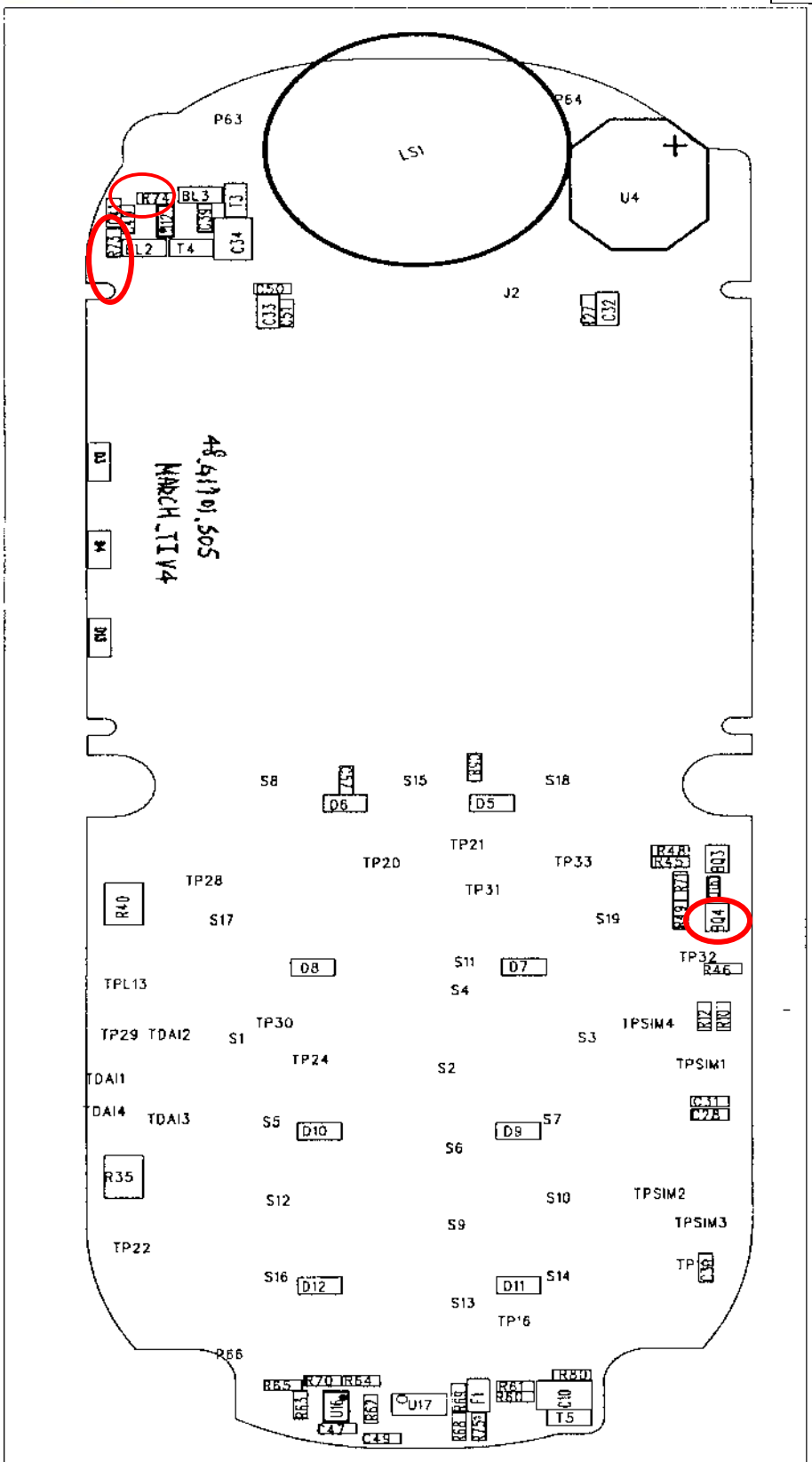
FAULTY VIBRATOR



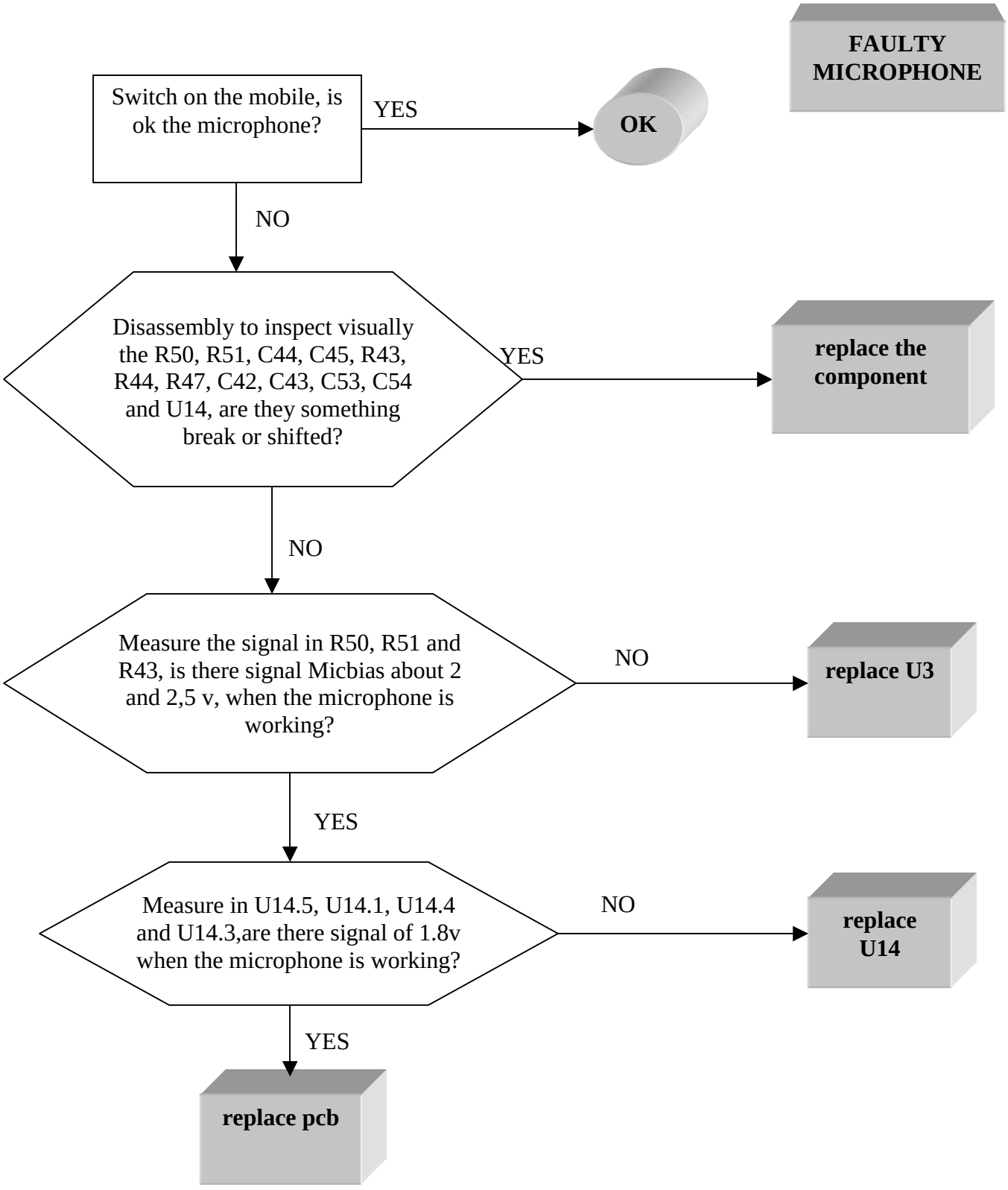

**I12:Reference bottom**


Swicth on the mobile, is audio speaker OK ?
YES
OK
FAULTY SPEAKER
NO
Disassembly to visually inspect the LS1,is it ok?
NO
replace LS1
YES
Measure in R73 and R74, are there signal +/- of 2v when the speaker is function?
NO
replace U3
YES
Measure the signal BQ4.3, BQ4.2 and BQ4.1, are there signal +/- of 2v when the speaker audio is working?.
NO
replace component
YES
replace PCB

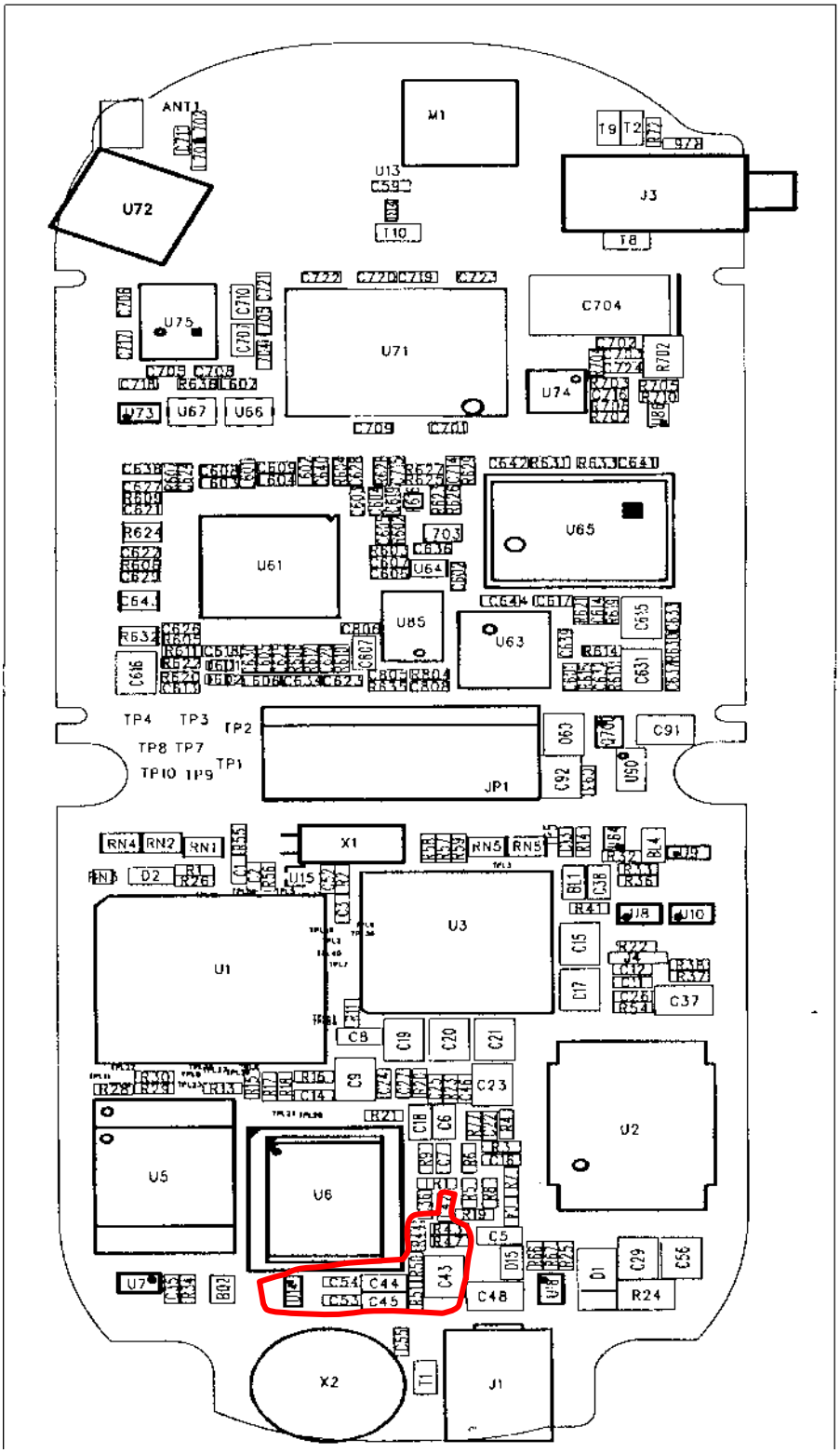
**SPEAKER FAULTY**

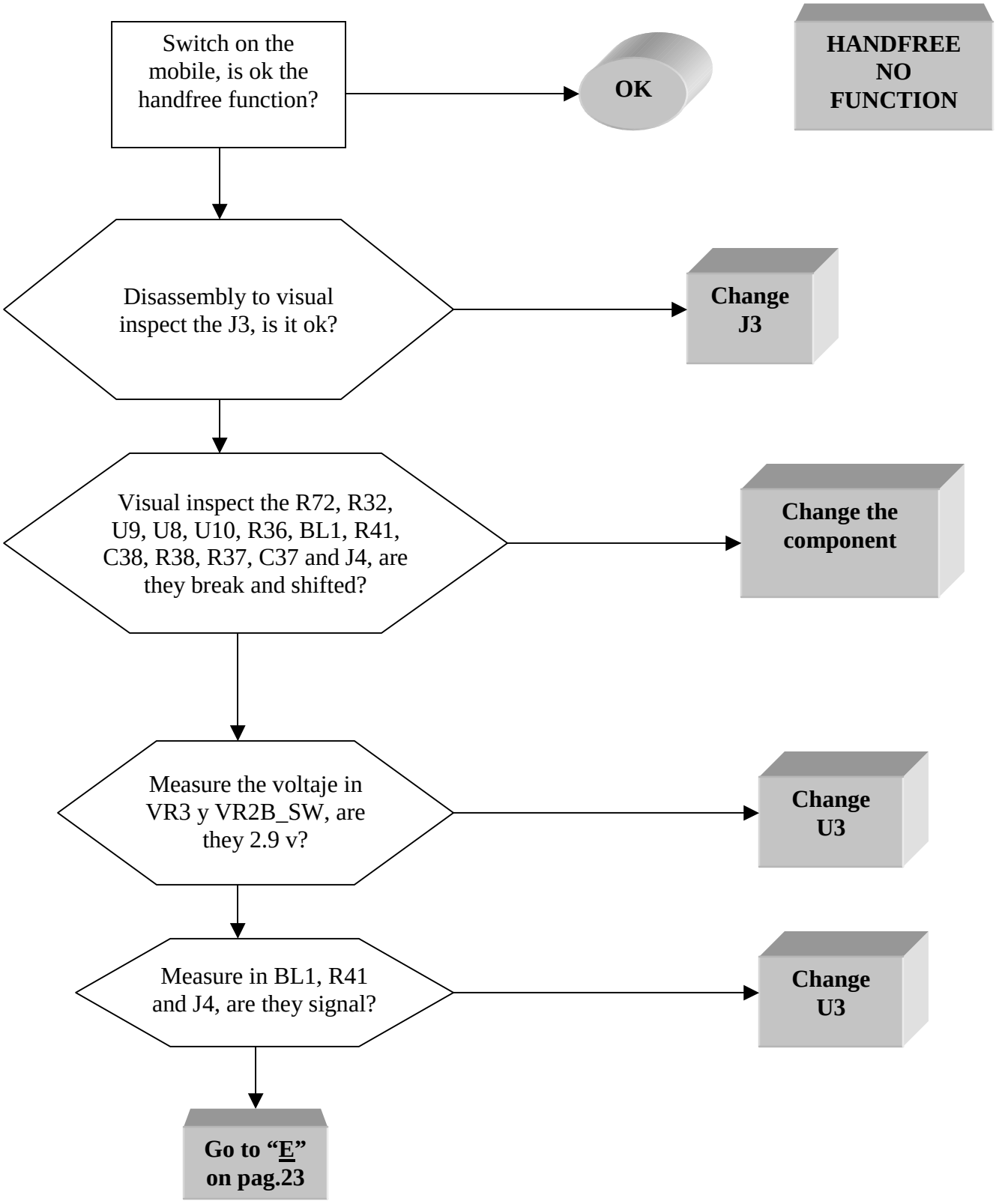


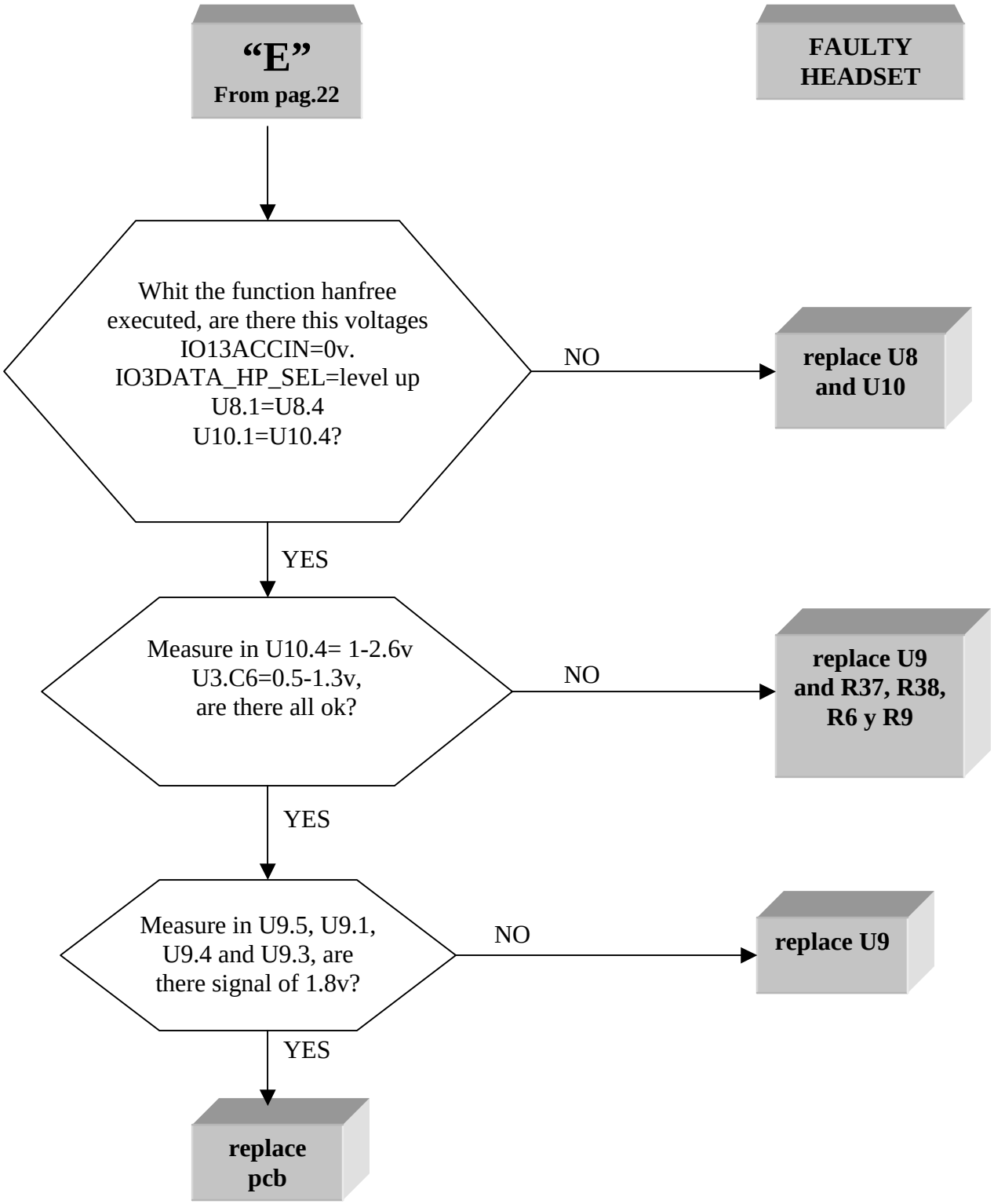

I12:Reference bottom


FAULTY MICROPHONE
Switch on the mobile, is ok the microphone?
YES
OK
NO
Disassembly to inspect visually the R50, R51, C44, C45, R43, R44, R47, C42, C43, C53, C54 and U14, are they something break or shifted?
YES
replace the component
NO
Measure the signal in R50, R51 and R43, is there signal Micbias about 2 and 2,5 v, when the microphone is working?
NO
replace U3
YES
Measure in U14.5, U14.1, U14.4 and U14.3,are there signal of 1.8v when the microphone is working?
NO
replace U14
YES
replace pcb

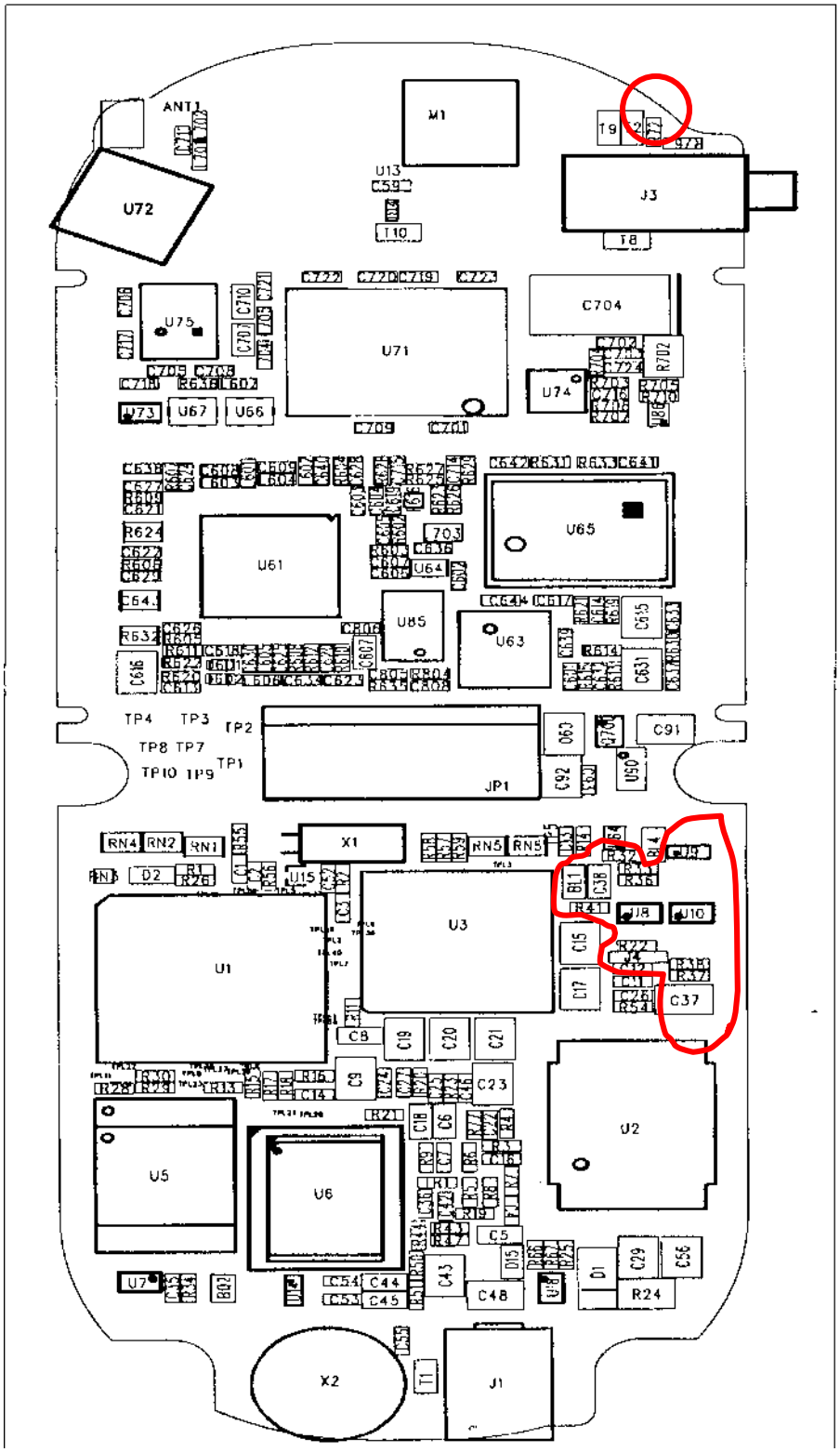
**FAULTY MICROPHONE**

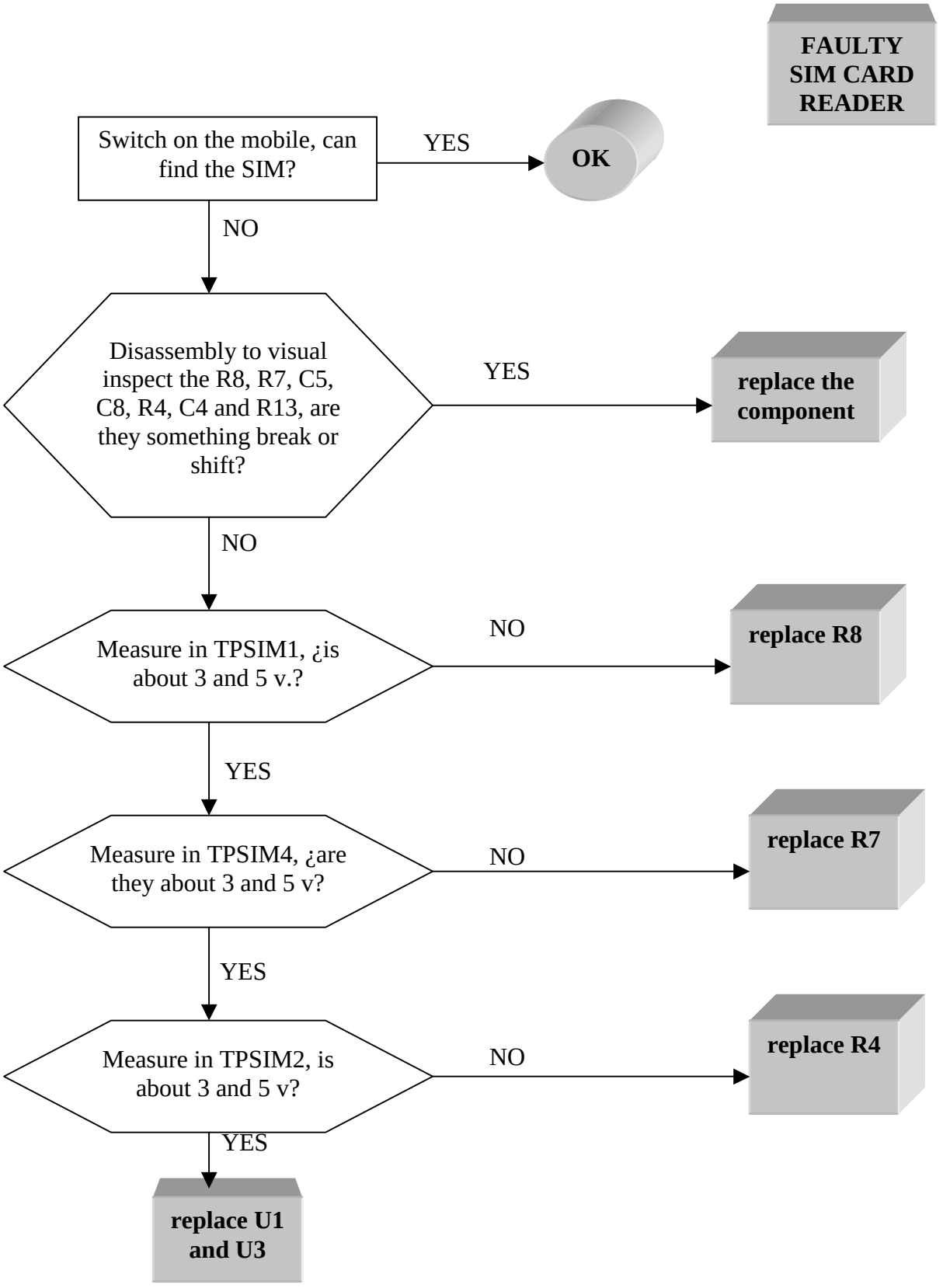



Switch on the mobile, is ok the handfree function?
OK
HANDFREE NO FUNCTION
Disassembly to visual inspect the J3, is it ok?
Change J3
Visual inspect the R72, R32, U9, U8, U10, R36, BL1, R41, C38, R38, R37, C37 and J4, are they break and shifted?
Change the component
Measure the voltaje in VR3 y VR2B_SW, are they 2.9 v?
Change U3
Measure in BL1, R41 and J4, are they signal?
Change U3
Go to "E" on pag.23

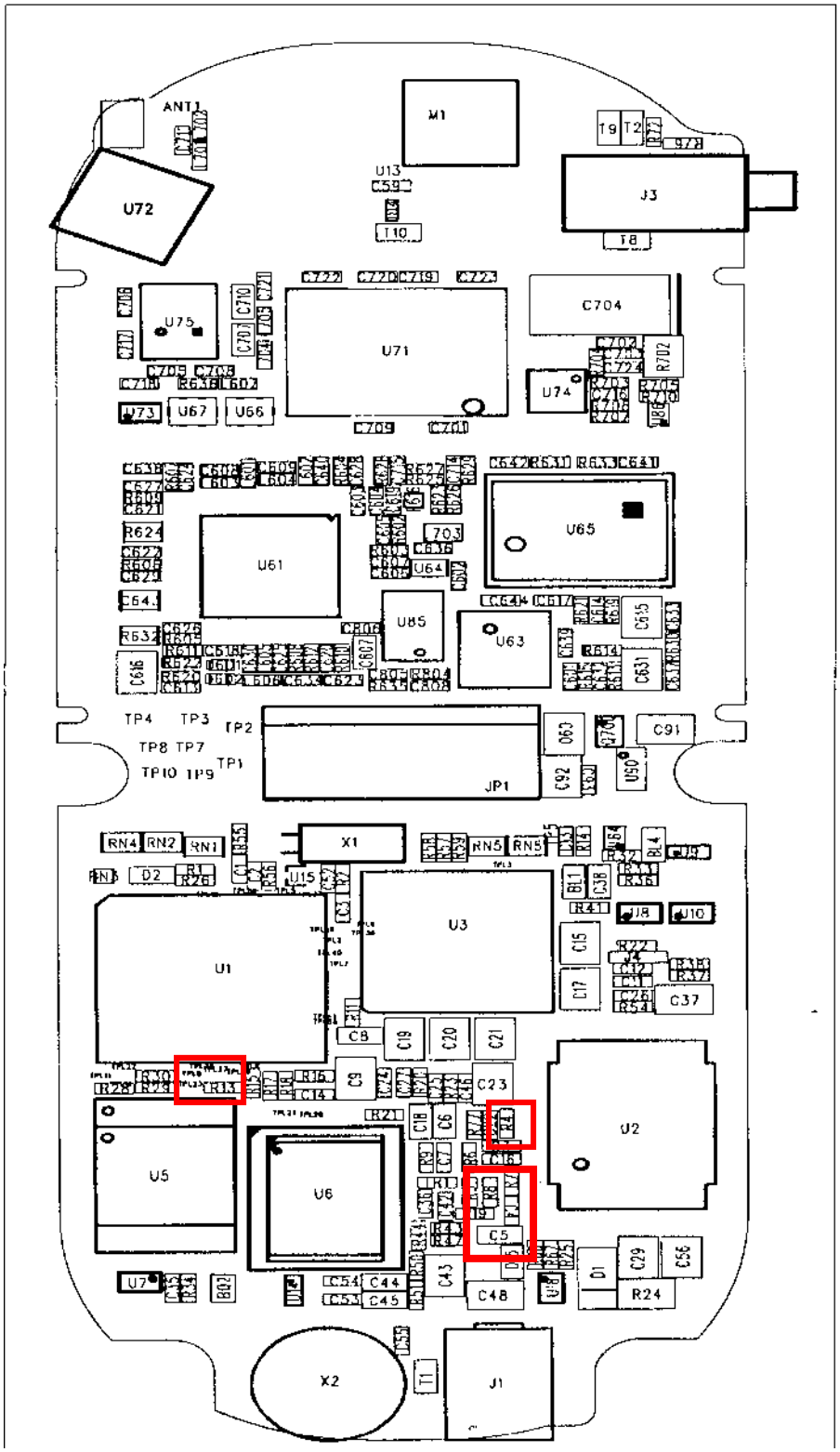

"E"
From pag.22
FAULTY HEADSET
Whit the function hanfree executed, are there this voltages IO13ACCIN=0v. IO3DATA_HP_SEL=level up U8.1=U8.4 U10.1=U10.4?
NO
replace U8 and U10
YES
Measure in U10.4= 1-2.6v U3.C6=0.5-1.3v, are there all ok?
NO
replace U9 and R37, R38, R6 y R9
YES
Measure in U9.5, U9.1, U9.4 and U9.3, are there signal of 1.8v?
NO
replace U9
YES
replace pcb

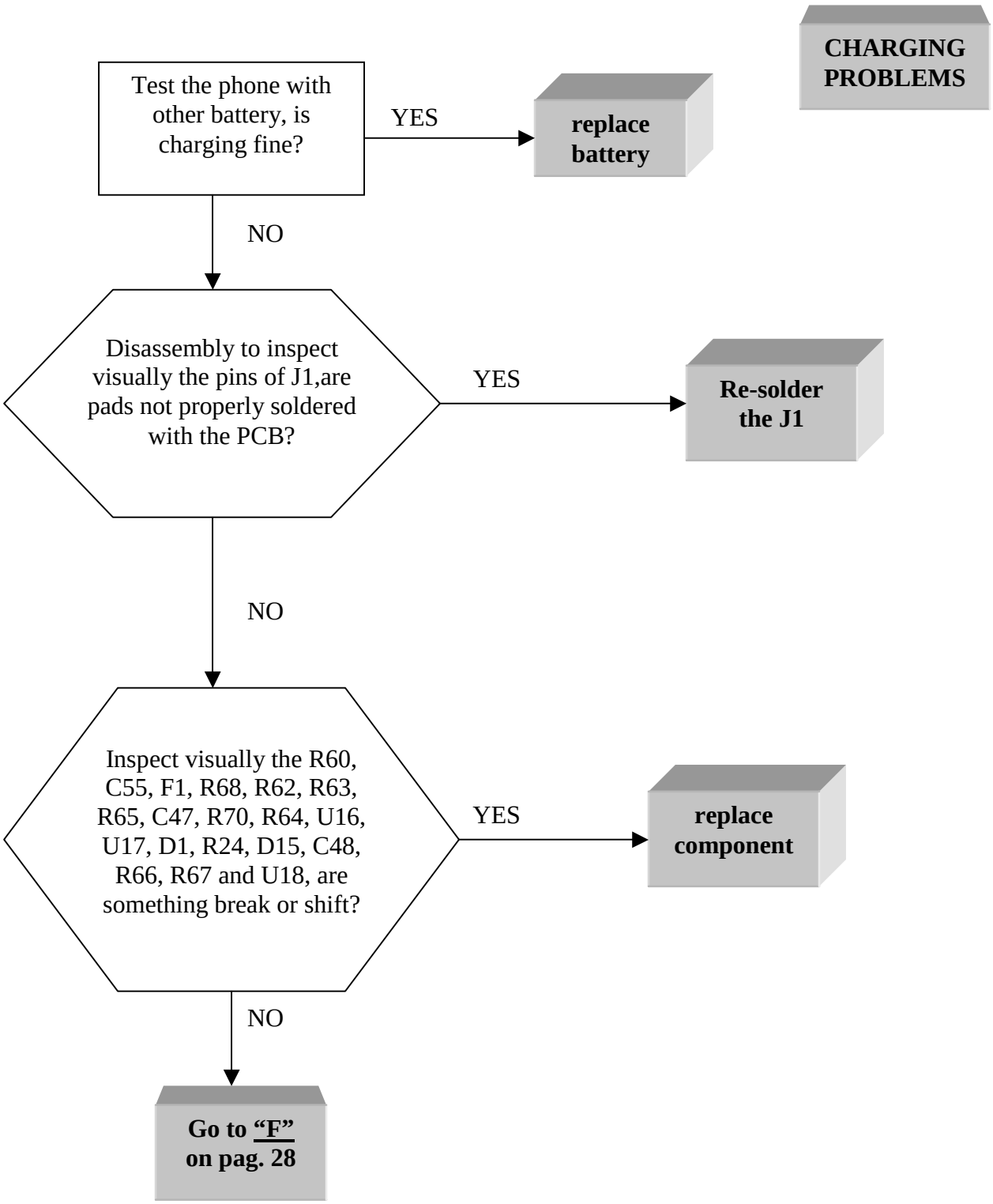
**FAULTY HEADSET**

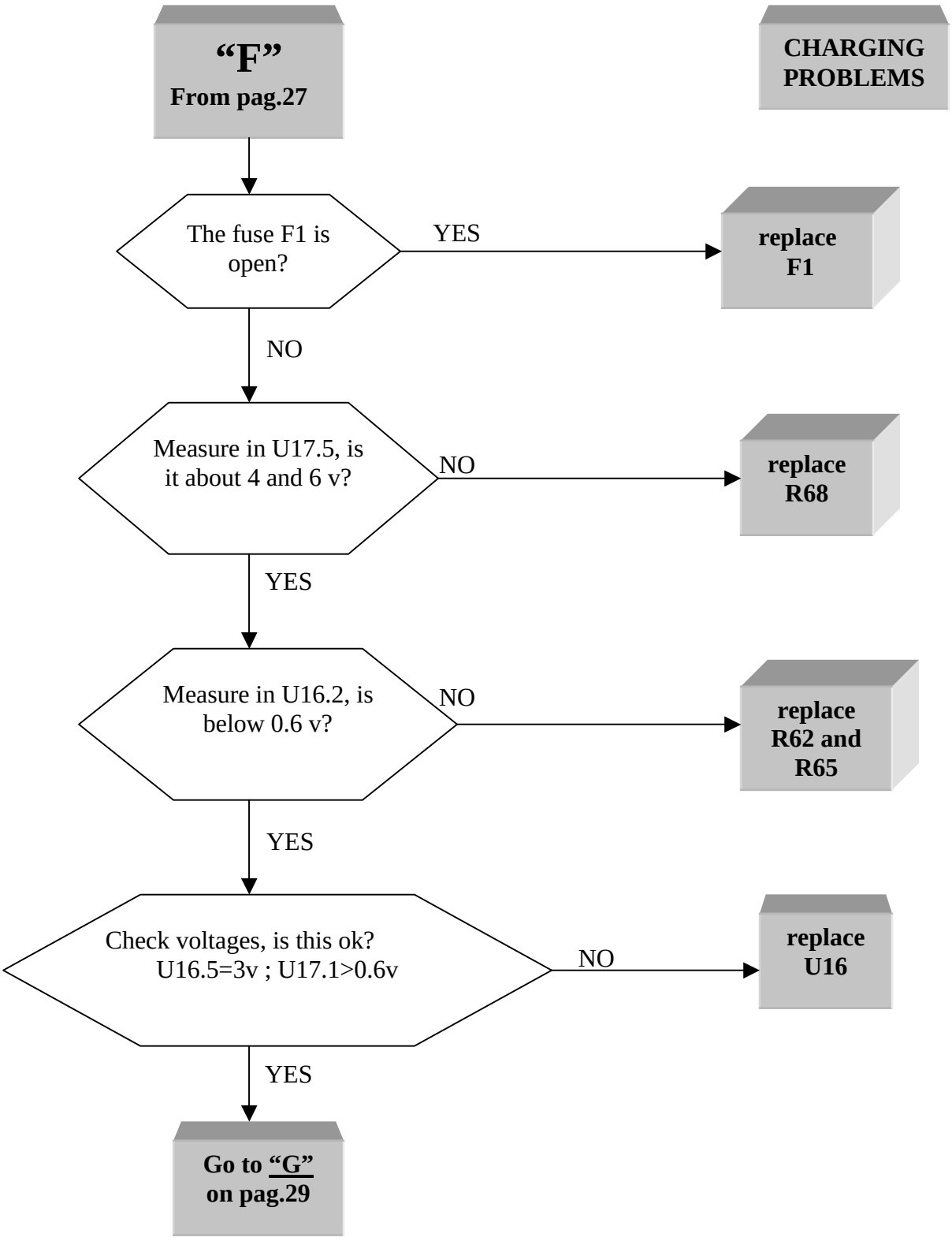


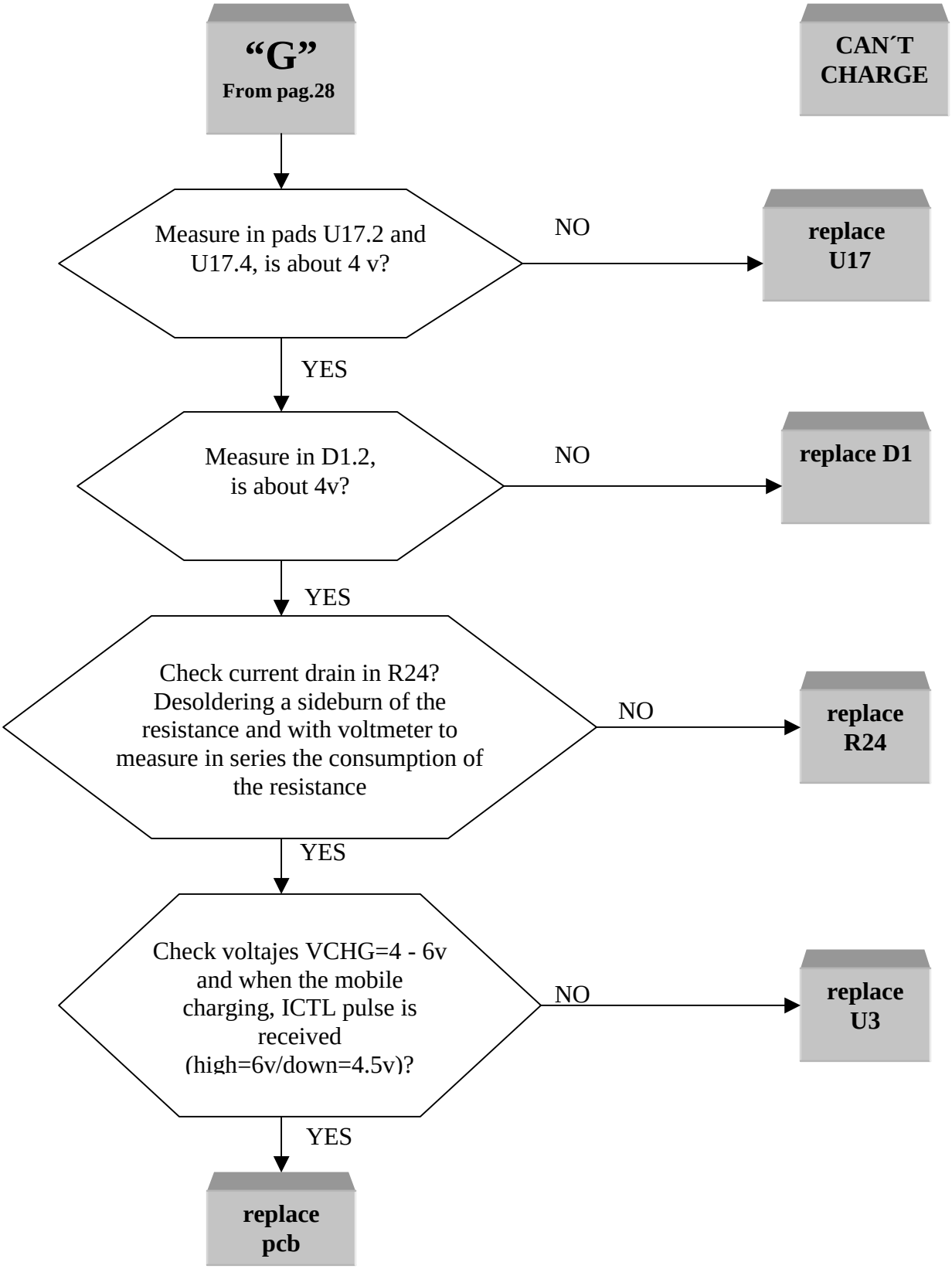

FAULTY SIM CARD READER
Switch on the mobile, can find the SIM?
YES
OK
NO
Disassembly to visual inspect the R8, R7, C5, C8, R4, C4 and R13, are they something break or shift?
YES
replace the component
NO
Measure in TPSIM1, ¿is about 3 and 5 v.?
NO
replace R8
YES
Measure in TPSIM4, ¿are they about 3 and 5 v?
NO
replace R7
YES
Measure in TPSIM2, is about 3 and 5 v?
NO
replace R4
YES
replace U1 and U3

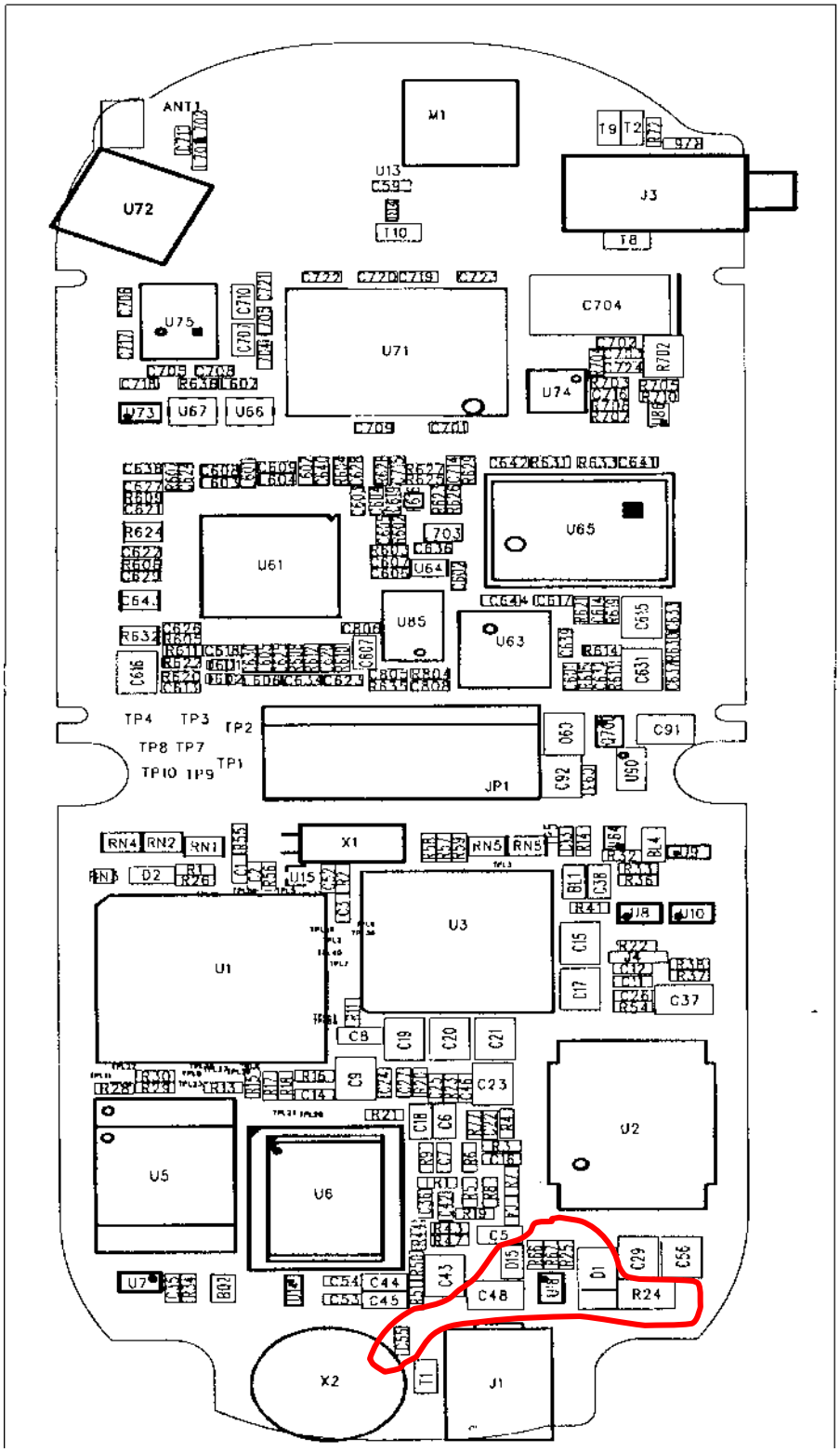
**FAULTY SIM CARD READER**

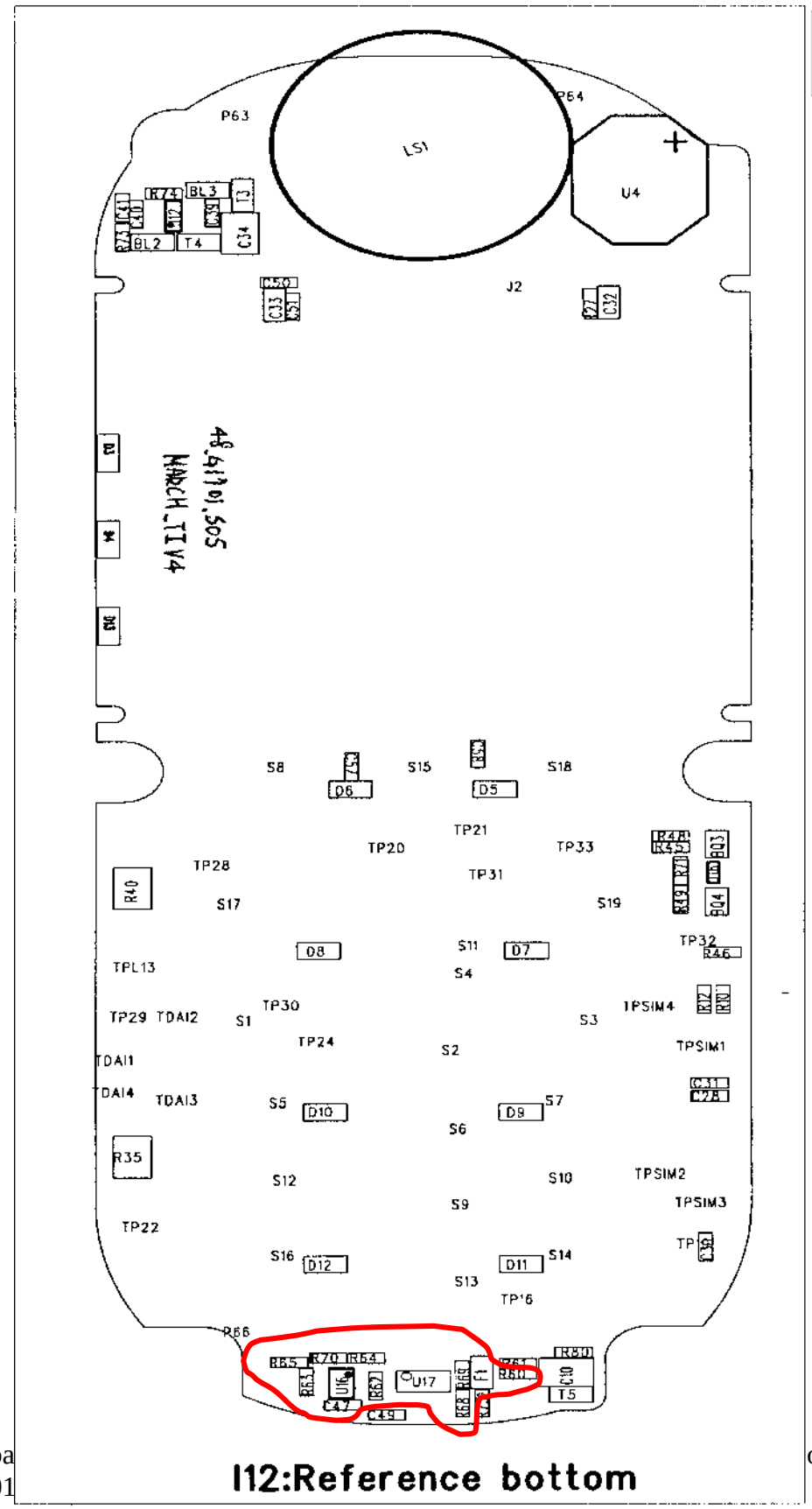



CHARGING PROBLEMS
Test the phone with other battery, is charging fine?
YES
replace battery
NO
Disassembly to inspect visually the pins of J1,are pads not properly soldered with the PCB?
YES
Re-solder the J1
NO
Inspect visually the R60, C55, F1, R68, R62, R63, R65, C47, R70, R64, U16, U17, D1, R24, D15, C48, R66, R67 and U18, are something break or shift?
YES
replace component
NO
Go to "F" on pag. 28

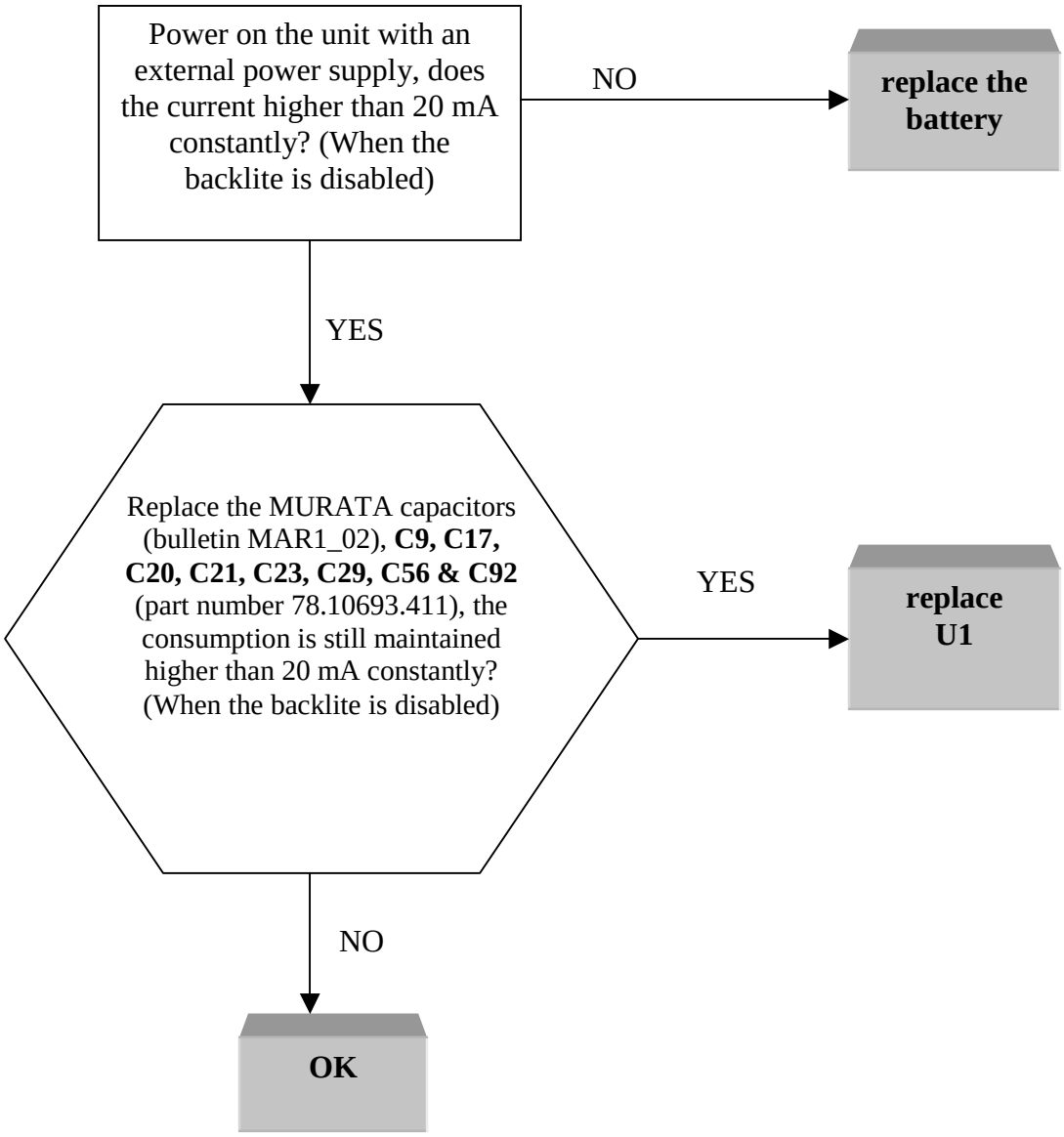

"F"
From pag.27
CHARGING PROBLEMS
The fuse F1 is open?
YES
replace F1
NO
Measure in U17.5, is it about 4 and 6 v?
NO
replace R68
YES
Measure in U16.2, is below 0.6 v?
NO
replace R62 and R65
YES
Check voltages, is this ok?
U16.5=3v ; U17.1>0.6v
NO
replace U16
YES
Go to "G" on pag.29


"G"
From pag.28
CAN´T CHARGE
Measure in pads U17.2 and U17.4, is about 4 v?
NO
replace U17
YES
Measure in D1.2, is about 4v?
NO
replace D1
YES
Check current drain in R24? Desoldering a sideburn of the resistance and with voltmeter to measure in series the consumption of the resistance
NO
replace R24
YES
Check voltajes VCHG=4 - 6v and when the mobile charging, ICTL pulse is received (high=6v/down=4.5v)?
NO
replace U3
YES
replace pcb

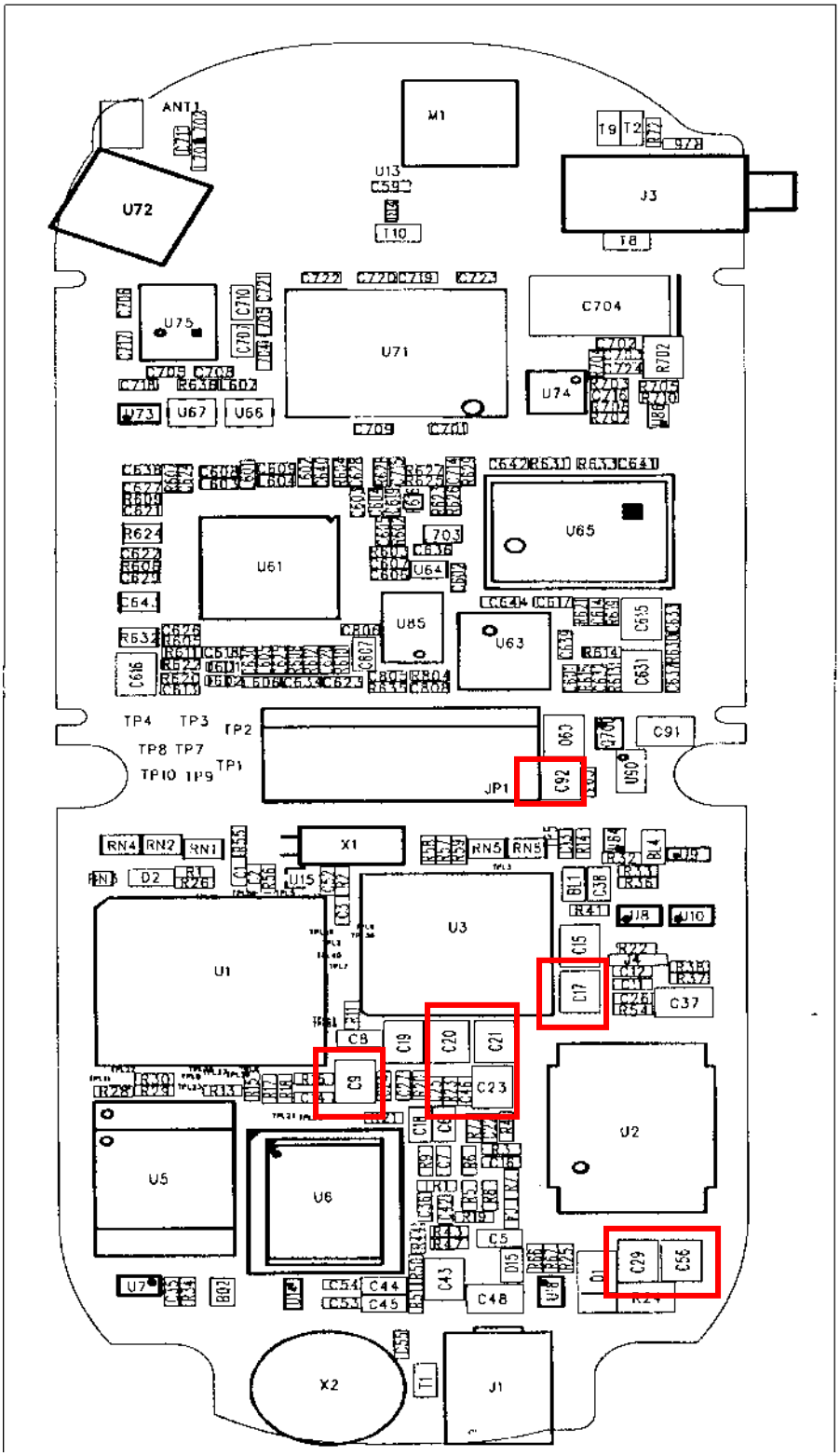

ANT1
M1
U72
U13
C59
T10
T9
T2
J3
T8
C722
C720
C719
C723
C704
U75
C710
C705
C701
U71
C708
C709
C701
U74
R702
C724
U73
U67
U66
C642
R631
R633
C641
U65
703
U61
R624
C622
C644
U64
U85
C615
C631
R632
C616
U63
C644
C617
C607
C604
TP4
TP3
TP2
TP8
TP7
TP10
TP9
TP1
JP1
C63
C92
C91
U50
RN4
RN2
RN1
X1
RN5
RN3
D2
U15
U3
U1
U8
U10
C15
C17
C37
C8
C18
C20
C21
C9
C23
C6
U2
U5
U6
C5
C43
C54
C44
C55
C45
C48
D15
D1
C29
C56
R24
U7
X2
T1
J1


P63
P64
LS1
U4
J2
S8
S15
S18
D6
D5
TP21
TP20
TP33
TP28
TP31
R40
S17
S19
D8
S11
D7
TP32
TPL13
S4
TP29
TDAI2
S1
TP30
S3
TPSIM4
TP24
S2
TPSIM1
TDAI1
TDAI4
TDAI3
S5
D10
S7
D9
S6
R35
S12
S10
TPSIM2
S9
TPSIM3
TP22
S16
D12
S14
D11
S13
TP16
R66
R65
R70
R64
U17
R61
R60
C10
T5
C47
C49
I12:Reference bottom

# HIGH CONSUMPTION IN STAND BY



**HIGH CONSUMPTION IN STAND BY**



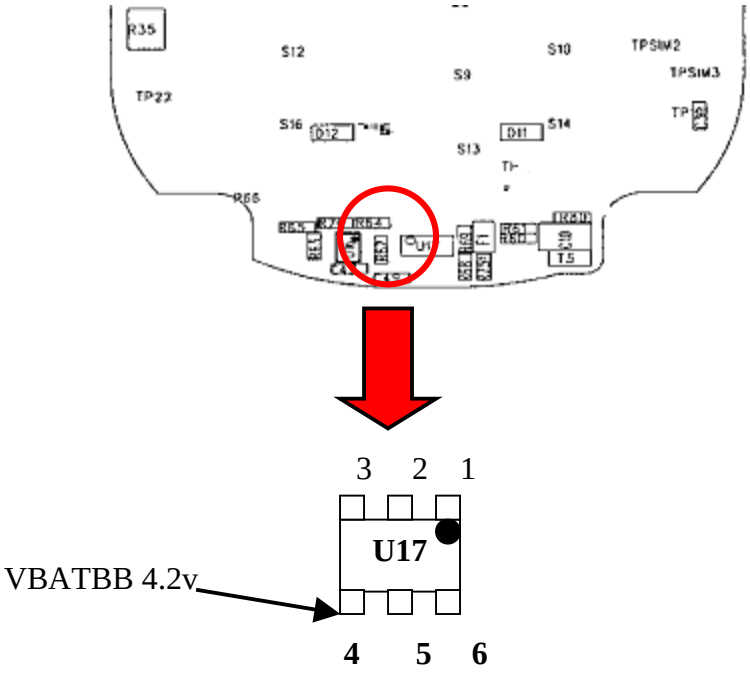
# Power off itself and slow charging display indication

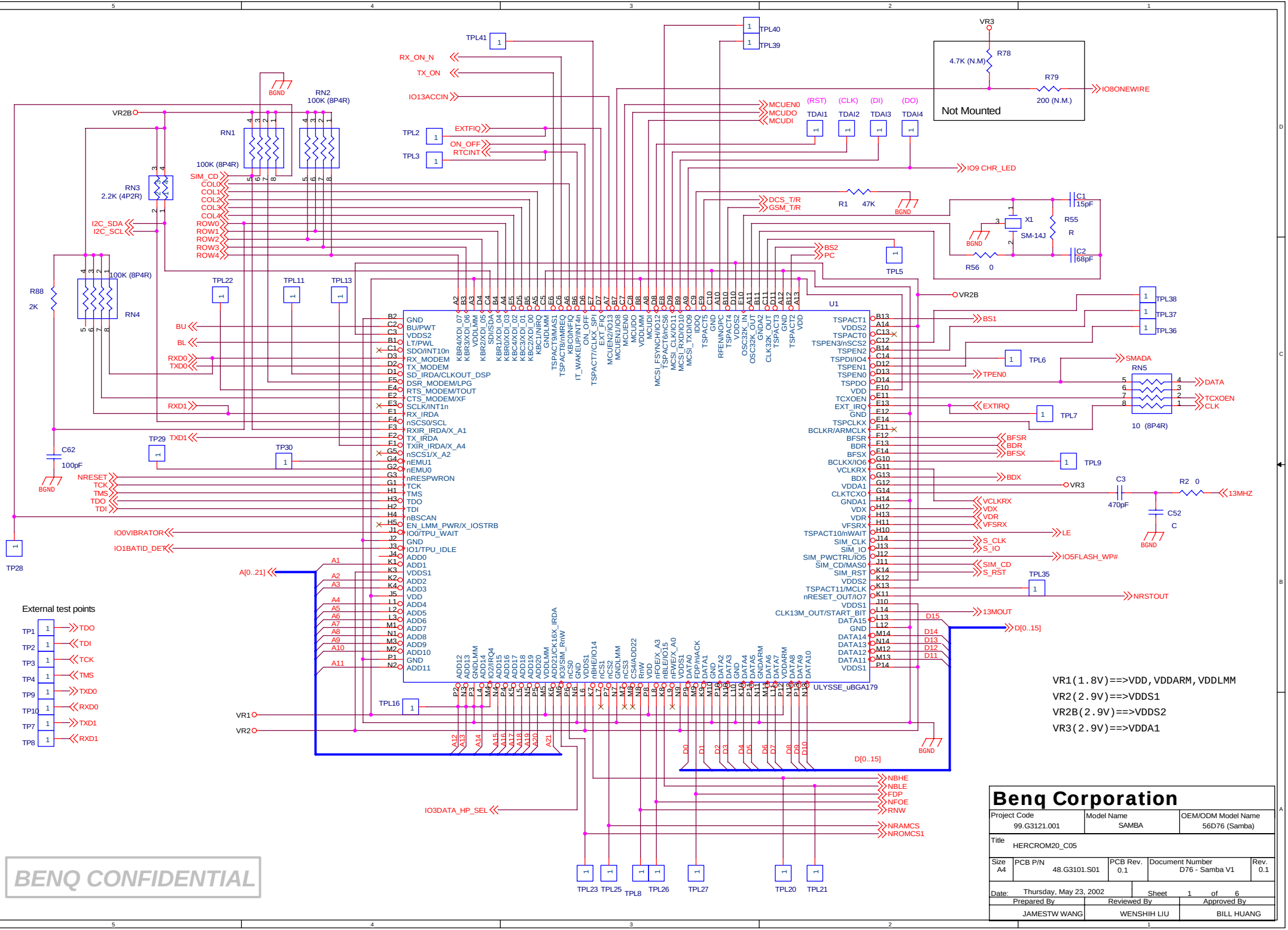
.

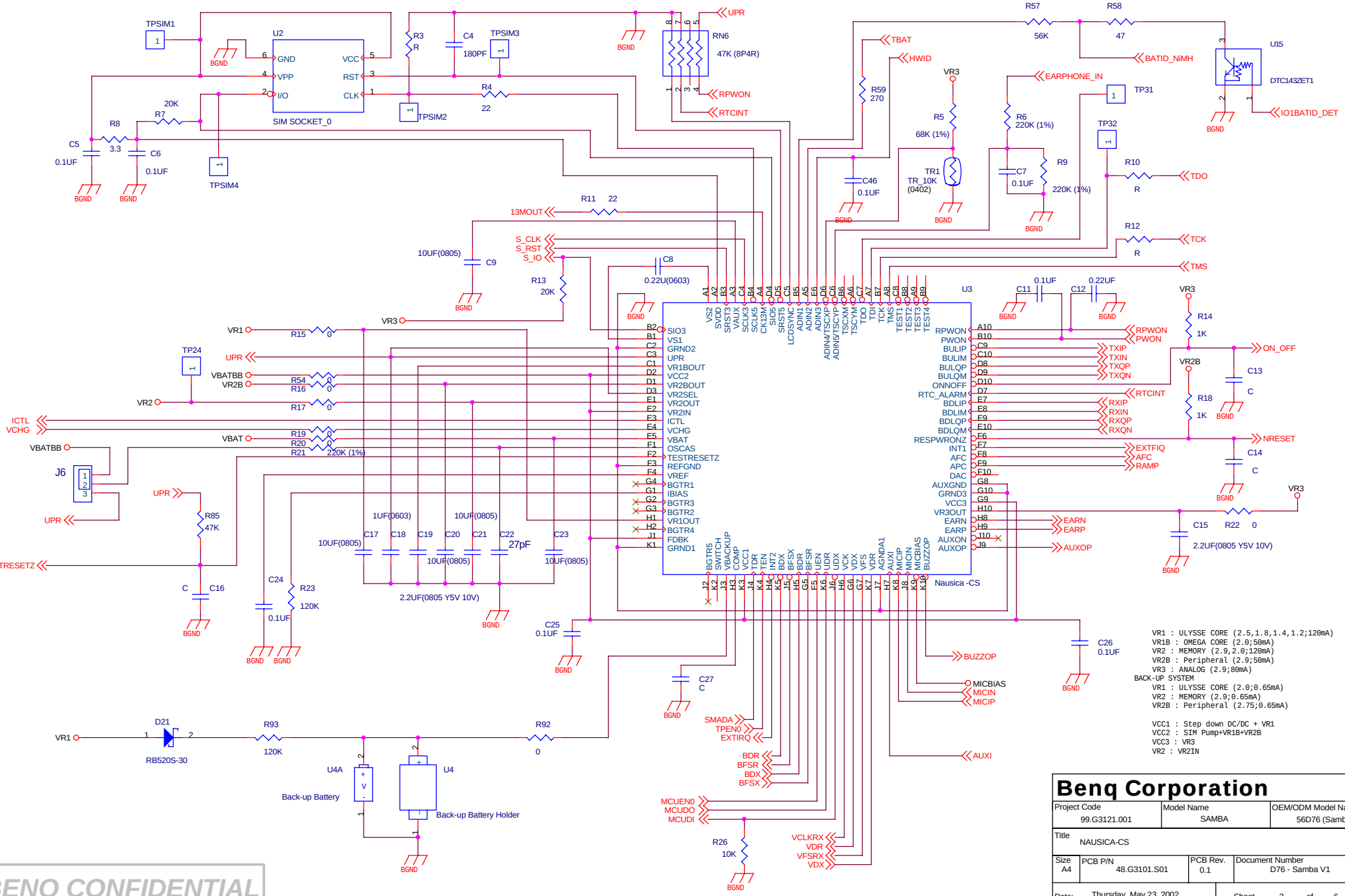
Insert a battery with charging lower than 2.8v, insert the wall adaptor connector in the J1, measure in the pad 4 of U17,
¿is the re 4.2 voltios?

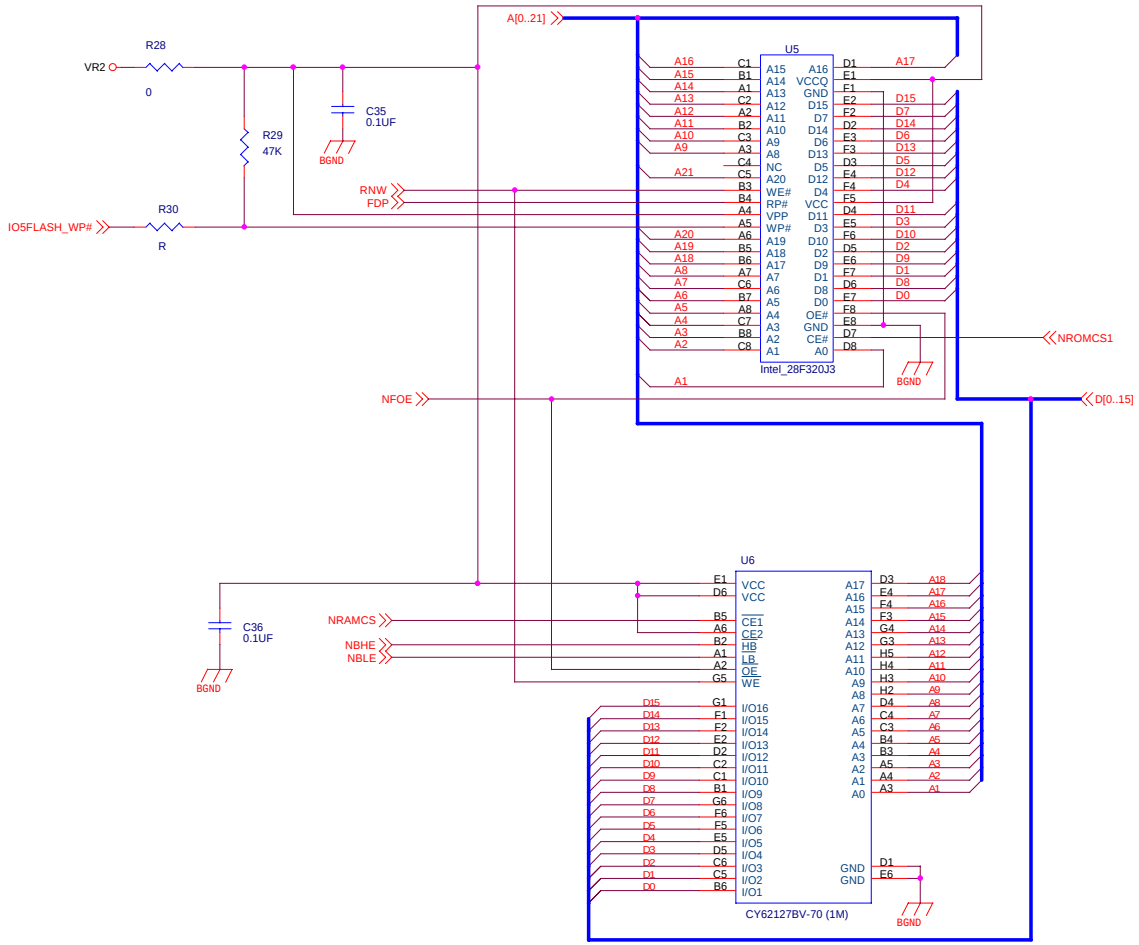
**NO** → **Replace U3**

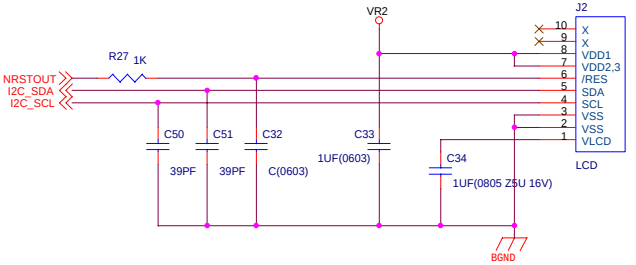
**YES** → **The mobile is OK**

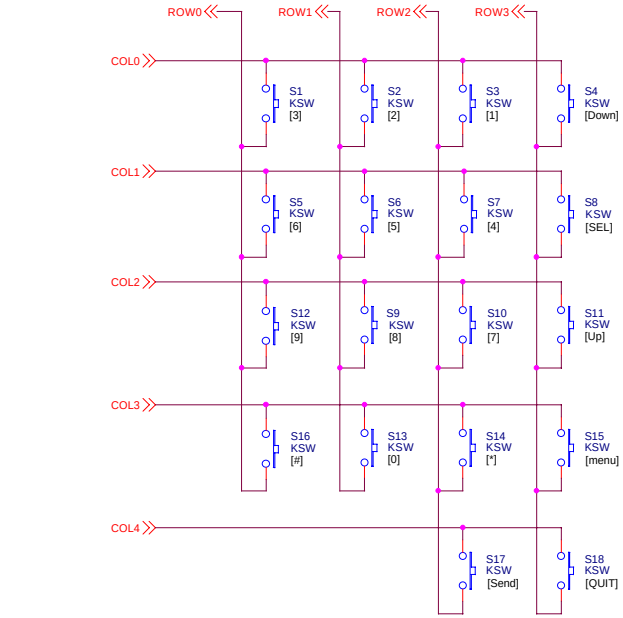


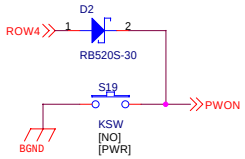

U1
ULYSSE_uBGA179
VR1(1.8V)==>VDD,VDDARM,VDDLMM
VR2(2.9V)==>VDDS1
VR2B(2.9V)==>VDDS2
VR3(2.9V)==>VDDA1
External test points
Not Mounted
BENQ CONFIDENTIAL
Benq Corporation
Project Code 99.G3121.001
Model Name SAMBA
OEM/ODM Model Name 56D76 (Samba)
Title HERCROM20_C05
Size A4
PCB P/N 48.G3101.S01
PCB Rev. 0.1
Document Number D76 - Samba V1
Rev. 0.1
Date: Thursday, May 23, 2002
Sheet 1 of 6
Prepared By JAMESTW WANG
Reviewed By WENSHIH LIU
Approved By BILL HUANG


TPSIM1
U2
SIM SOCKET_0
GND
VPP
I/O
VCC
RST
CLK
R3
R
C4
180PF
TPSIM3
TPSIM2
R4
22
RN6
47K (8P4R)
UPR
RPWON
RTCINT
R7
20K
R8
3.3
C5
0.1UF
C6
0.1UF
TPSIM4
BGND
13MOUT
R11
22
S_CLK
S_RST
S_IO
C9
10UF(0805)
C8
0.22U(0603)
R13
20K
VR3
VR1
R15
0
TP24
VBATBB
VR2B
R54
R16
R17
VR2
ICTL
VCHG
VBAT
R19
R20
R21
220K (1%)
J6
TESTRESETZ
R85
47K
C16
C
R23
120K
C24
0.1UF
C17
C18
C19
C20
C21
C22
27pF
C23
10UF(0805)
1UF(0603)
2.2UF(0805 Y5V 10V)
C25
0.1UF
C27
C
SIO3
VS1
GRND2
VR1BOUT
VCC2
VR2BOUT
VR2SEL
VR2OUT
VR2IN
VCHG
VBAT
OSCAS
TESTRESETZ
REFGND
VREF
BGTR1
IBIAS
BGTR3
BGTR2
VR1OUT
BGTR4
FDBK
GRND1
Nausica -CS
R57
56K
R58
47
BATID_NiMH
U15
DTC143ZET1
IO1BATID_DET
TBAT
HWID
R59
270
C46
0.1UF
EARPHONE_IN
TP31
R5
68K (1%)
TR1
TR_10K
(0402)
R6
220K (1%)
C7
0.1UF
R9
220K (1%)
TP32
R10
R
TDO
R12
R
TCK
TMS
U3
C11
0.1UF
C12
0.22UF
R14
1K
VR2B
R18
1K
C13
C
ON_OFF
NRESET
C14
C
C15
2.2UF(0805 Y5V 10V)
R22
0
RPWON
PWON
BULIP
BULIM
BULQP
BULQM
ONNOFF
RTC_ALARM
BDLIP
BDLIM
BDLQP
BDLQM
RESPWRONZ
INT1
AFC
APC
DAC
AUXGND
GRND3
VCC3
VR3OUT
EARN
EARP
AUXON
AUXOP
TXIP
TXIN
TXQP
TXQN
RXIP
RXIN
RXQP
RXQN
EXTFIQ
AFC
RAMP
EARN
EARP
AUXOP
BUZZOP
MICBIAS
MICIN
MICIP
AUXI
SMADA
TPEN0
EXTIRQ
BDR
BFSR
BDX
BFSX
MCUEN0
MCUDO
MCUDI
R26
10K
VCLKRX
VDR
VFSRX
VDX
D21
RB520S-30
R93
120K
R92
0
U4A
Back-up Battery
U4
Back-up Battery Holder
C26
0.1UF
VR1 : ULYSSE CORE (2.5,1.8,1.4,1.2;120mA)
VR1B : OMEGA CORE (2.0;50mA)
VR2 : MEMORY (2.9,2.0;120mA)
VR2B : Peripheral (2.9;50mA)
VR3 : ANALOG (2.9;80mA)
BACK-UP SYSTEM
VR1 : ULYSSE CORE (2.0;0.65mA)
VR2 : MEMORY (2.9;0.65mA)
VR2B : Peripheral (2.75;0.65mA)
VCC1 : Step down DC/DC + VR1
VCC2 : SIM Pump+VR1B+VR2B
VCC3 : VR3
VR2 : VR2IN
Benq Corporation
Project Code
99.G3121.001
Model Name
SAMBA
OEM/ODM Model Name
56D76 (Samba)
Title
NAUSICA-CS
Size
A4
PCB P/N
48.G3101.S01
PCB Rev.
0.1
Document Number
D76 - Samba V1
Rev.
0.1
Date:
Thursday, May 23, 2002
Sheet
2
of
6
Prepared By
JAMESTW WANG
Reviewed By
WENSHIH LIU
Approved By
BILL HUANG
BENQ CONFIDENTIAL




BENQ CONFIDENTIAL

# Benq Corporation

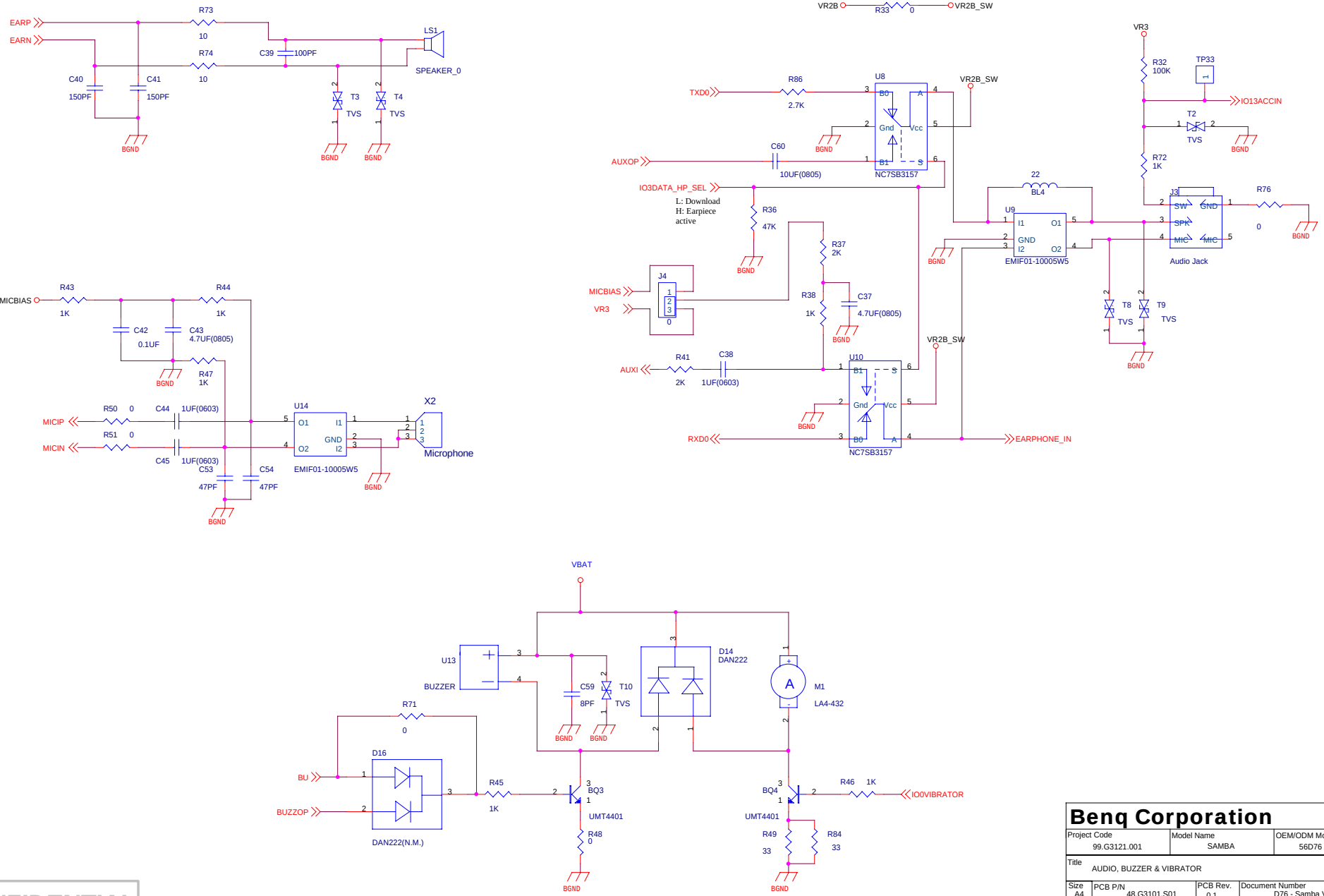
| Project Code | Model Name | OEM/ODM Model Name |
|---|---|---|
| 99.G3121.001 | SAMBA | 56D76 (Samba) |

Title: MEMORY,LCD,KEYPAD

| Size | PCB P/N | PCB Rev. | Document Number | Rev. |
|---|---|---|---|---|
| A4 | 48.G3101.S01 | 0.1 | D76 - Samba V1 | 0.1 |

Date: Thursday, May 23, 2002 Sheet 3 of 6

| Prepared By | Reviewed By | Approved By |
|---|---|---|
| JAMESTW WANG | WENSHIH LIU | BILL HUANG |




BENQ CONFIDENTIAL

# Benq Corporation

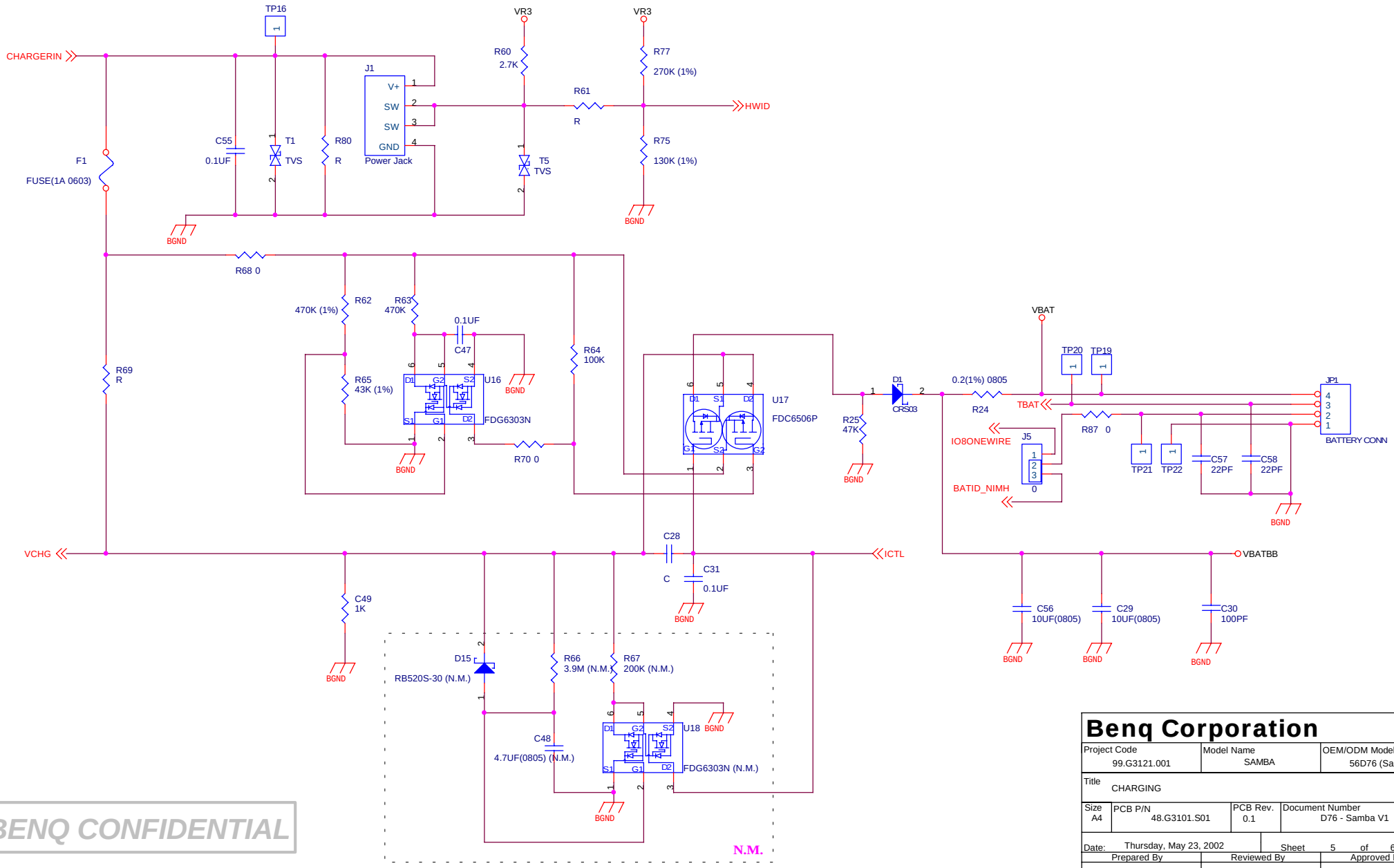
| Project Code | Model Name | OEM/ODM Model Name |
|---|---|---|
| 99.G3121.001 | SAMBA | 56D76 (Samba) |

Title: AUDIO, BUZZER & VIBRATOR

| Size | PCB P/N | PCB Rev. | Document Number | Rev. |
|---|---|---|---|---|
| A4 | 48.G3101.S01 | 0.1 | D76 - Samba V1 | 0.1 |

Date: Thursday, May 23, 2002 Sheet 4 of 6

| Prepared By | Reviewed By | Approved By |
|---|---|---|
| JAMESTW WANG | WENSHIH LIU | BILL HUANG |




BENQ CONFIDENTIAL

# Benq Corporation

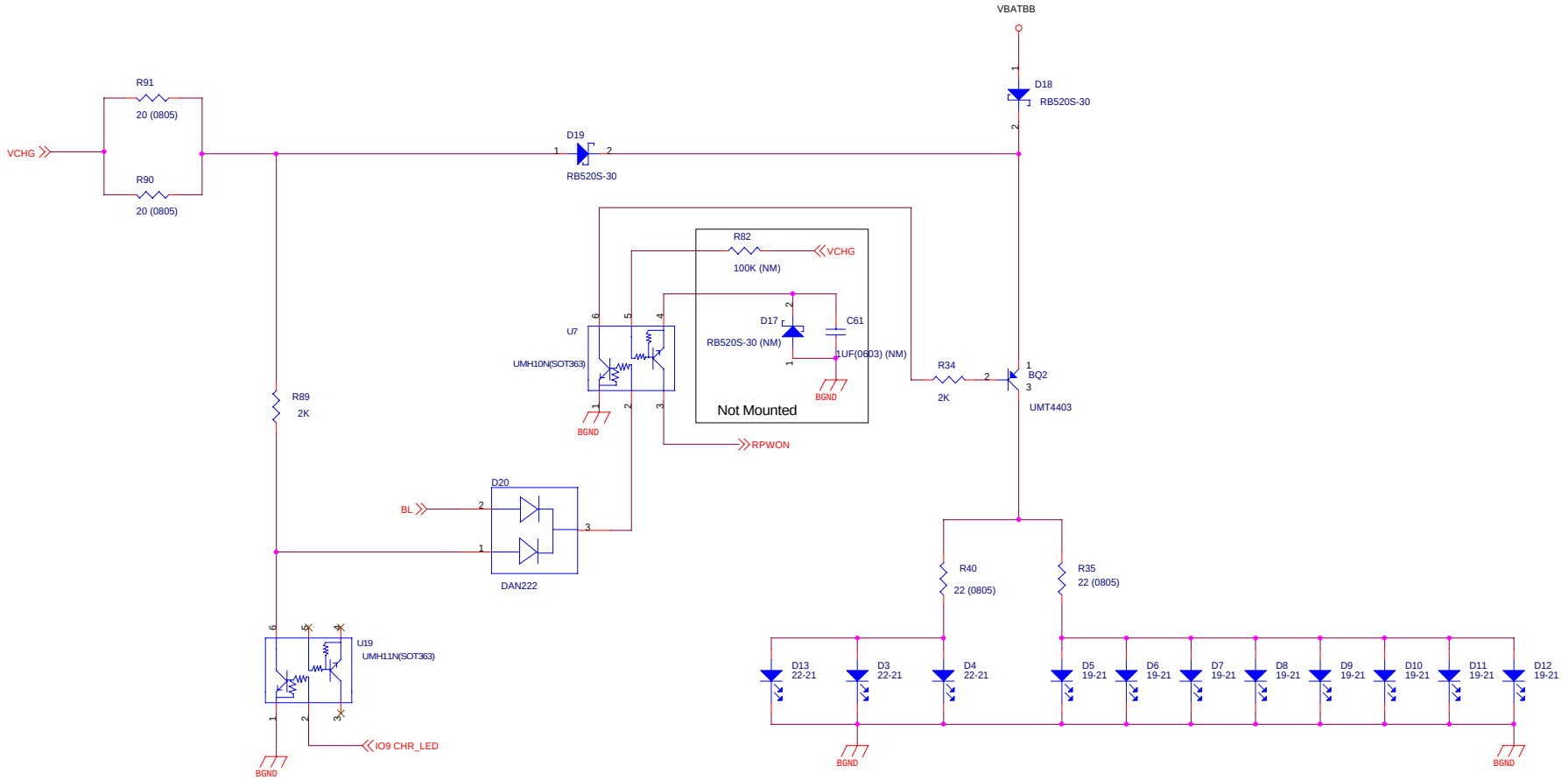
| Project Code | Model Name | OEM/ODM Model Name |
|---|---|---|
| 99.G3121.001 | SAMBA | 56D76 (Samba) |

Title: CHARGING

| Size | PCB P/N | PCB Rev. | Document Number | Rev. |
|---|---|---|---|---|
| A4 | 48.G3101.S01 | 0.1 | D76 - Samba V1 | 0.1 |

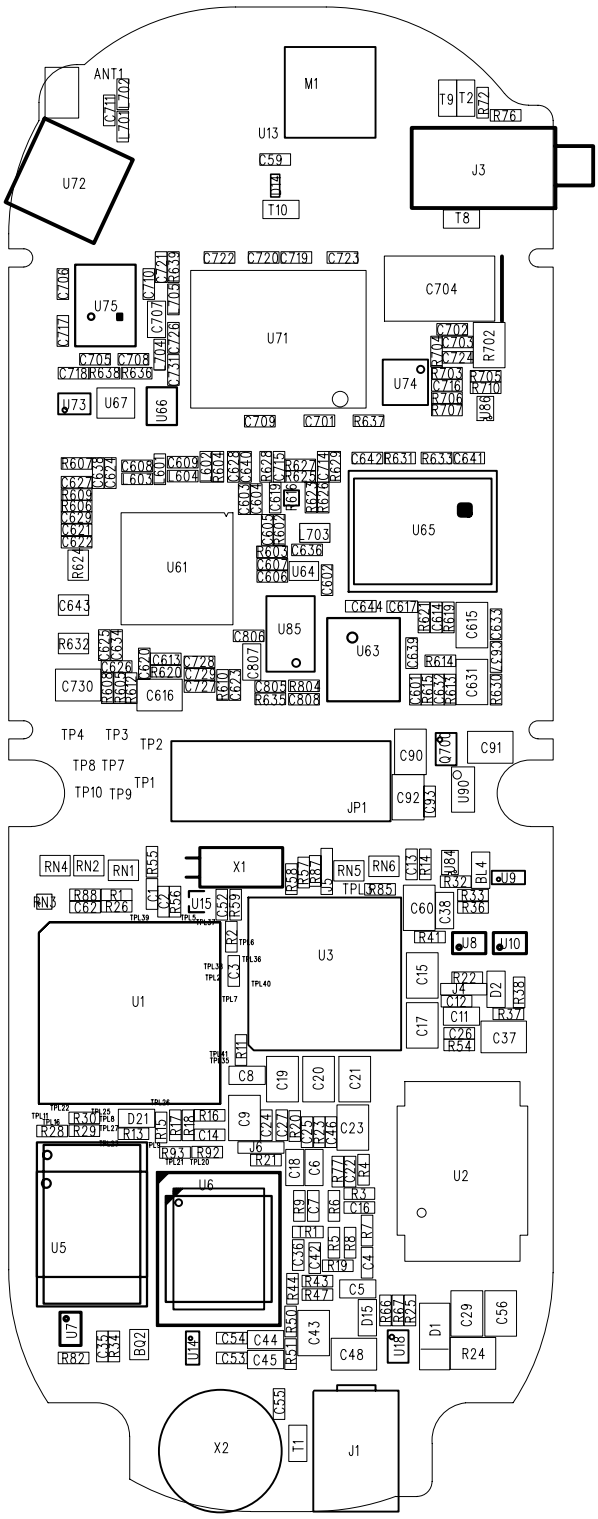
Date: Thursday, May 23, 2002 Sheet 5 of 6

| Prepared By | Reviewed By | Approved By |
|---|---|---|
| JAMESTW WANG | WENSHIH LIU | BILL HUANG |

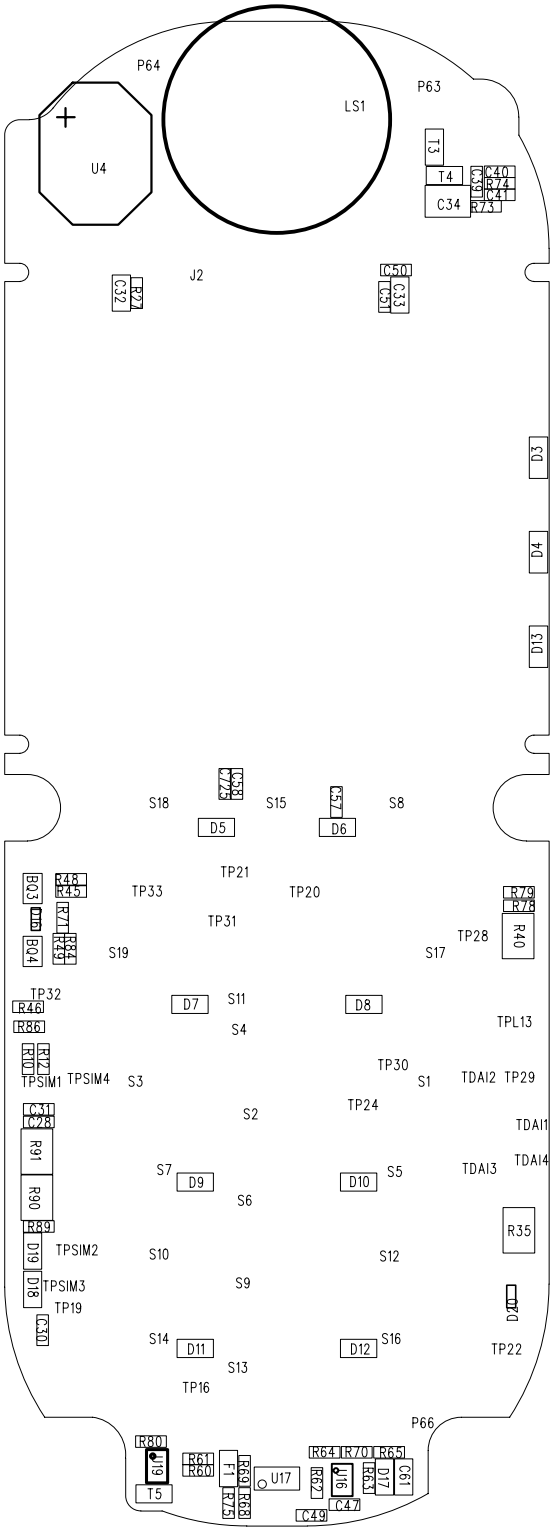



BENQ CONFIDENTIAL

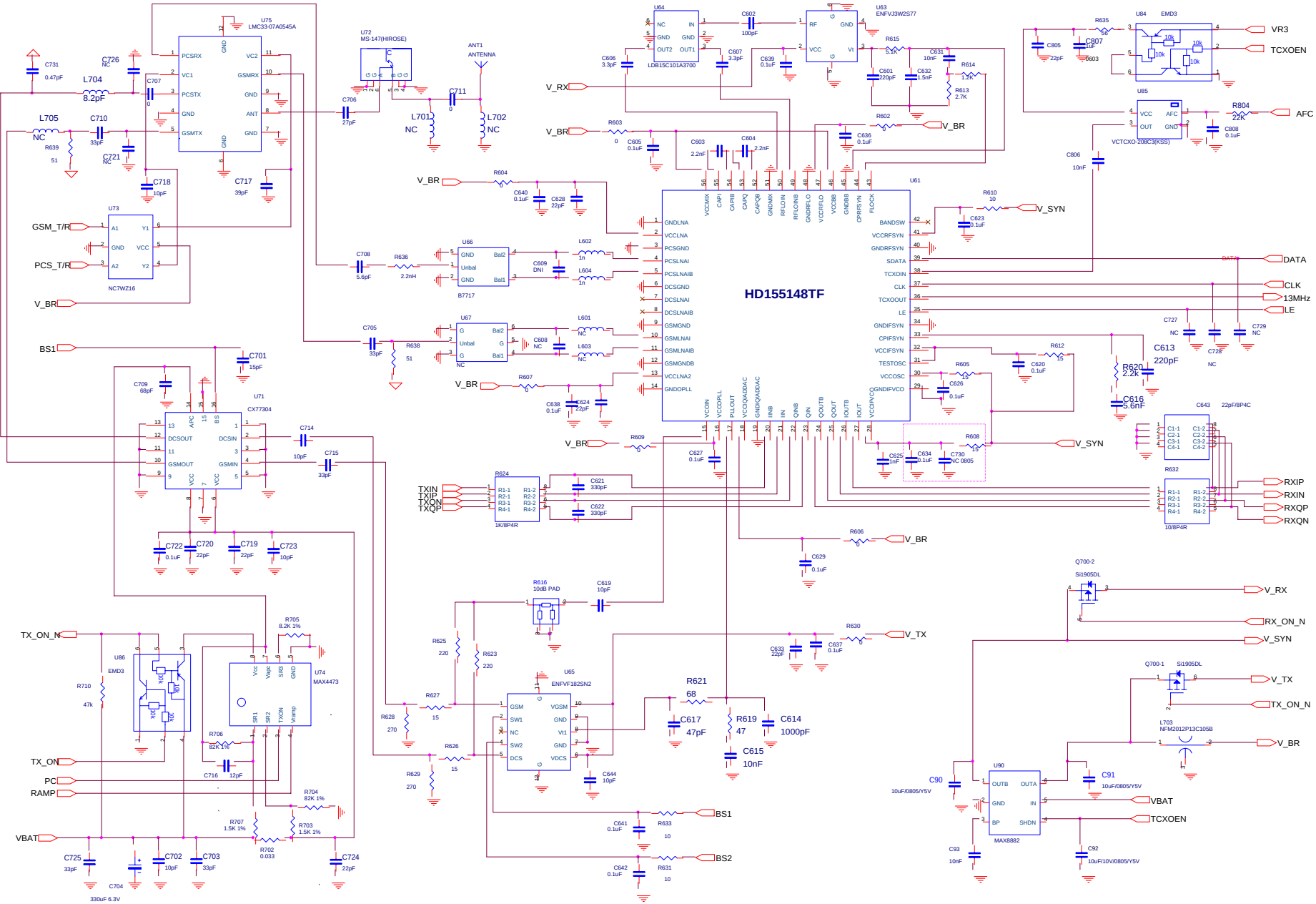
| Benq Corporation | | |
|---|---|---|
| Project Code: 99.G3121.001 | Model Name: SAMBA | OEM/ODM Model Name: 56D76 (Samba) |
| Title: LED | | |
| Size: A4 | PCB P/N: 48.G3101.S01 | PCB Rev.: 0.1 |
| Document Number: D76 - Samba V1 | | Rev.: 0.1 |
| Date: Thursday, May 23, 2002 | Sheet 6 of 6 | |
| Prepared By: JAMESTW WANG | Reviewed By: WENSHIH LIU | Approved By: BILL HUANG |




| | | | |
|---|---|---|---|
| BenQ | Layer: REFERENCE TOP | File Name: SAMBA V1(March_TI pcs) | |
| | Project Code: 99.G3121.001 | Date: 2002/03/01 | Rev: V1 |
| | Molde No.: 56D76 | Doc.No: 305-C01 | Rev: 0 |
| | Part No.: 48.G3101.S01 | Sheet 3 of 18 | |




| | | |
|---|---|---|
| BenQ | Layer: REFERENCE BOTTOM | File Name: SAMBA V1(March_TI pcs) |
| | Project Code: 99.G3121.001 | Date: 2002/03/01 Rev: V1 |
| | Molde No.: 56D76 | Doc.No: 305-C01 Rev: 0 |
| | Part No.: 48.G3101.S01 | Sheet 4 of 18 |



GSM Service Support Level 3 Authorized

# Dual Band T191

ANT 1

CALIBRATION RF PORT

RF ANTENNA

U72

U75

DIPLEXER

CONTROL FUNCTION

TX / RX Switch

U73 RF Switch Control

GSM_T/R GSM TX

V_BR (VCC)

DCS_T/R DCS TX

(Both Low For RX)

925-960MHz

GSM_RX

DCS_RX

1805-1880MHz

U66

U67

GSMPA

DCSPA

**EGSM RX**
Low Channel - 975 = 925.2Mhz
Mid Channel - 37 = 942.4Mhz
High Channel - 124 = 959.8Mhz

**GSM 1800 RX**
Low Channel - 512 = 1805.2Mhz
Mid Channel - 700 = 1842.8Mhz
High Channel - 885 = 1879.8Mhz

**RF VCO**
GSM 900 - 3700.8 Mhz - 3839.2 Mhz
GSM 1800 - 3604.4 Mhz - 3753.6 Mhz

U64 RF BALUN

U63 RF VCO

V_RX

**EGSM TX**
Low Channel - 975 = 880.2Mhz
Mid Channel - 37 = 897.4.4Mhz
High Channel - 124 = 914.8Mhz

**GSM 1800 TX**
Low Channel - 512 = 1710.2Mhz
Mid Channel - 700 = 1747.8Mhz
High Channel - 885 = 1784.8Mhz

BS1

VBAT

U71 PA

DCSPA

GSMPA

CMOS

TX_DCS

TX_GSM

BS

R616 Attn

TX_ON

TX_ON_N

VBAT

U86

R702 (I-Sense Resistor)

R706

R703

RAMP (From Omega)

PAC IC U74

Buffer

V to I Converter

Error Amp

PC (Enable)

R705 (Limits O/P Pwr)

APC

U65 TX VCO

BS1

BS2

V_TX

TX LOOP FILTER

V_SYN

Q700 - 2

V_RX

RX_ON_N

U90 Dual Regulator

TCXOEN

V_BR

Q700 - 1

V_TX

V_BR

47, 51, 46

13, 15, 23

RF PSU

Supports:
VCC for GSM 1800 LNA - 13
VCC for OPLL & Phase detector - 15
VCC for IQ Modulator - 23
VCC for BaseBand - 46
VCC for RF Local Buffer & Divider - 47
VCC for Direct Conversion Mixers - 51

90° 1/2

Control Logic

R632

RXQN

RXQP

RXIN

RXIP

IF PSU

V_SYN

Supports:
VCC for IFVCO & Divider
VCC for IF Synth & TCXO Divider (!3Mhz)
VCC for RF Synth & TCXO I/P Buffer (13Mhz)

(SPI BUS)

DATA

CLK

U84

VR3

TCXOEN

U85

AFC

13Mhz

Phase Det Charge Pump

N

IF SYNTH 360Mhz

DCS

EGSM

IQ MOD

R624

TXI

TXQ

U61
DUAL-BAND TRANCEIVER IC

| | |
|---|---|
| GSM SERVICE SUPPORT GROUP | 01.11.13 |
| LEVEL 3 RF Block Diagram | Rev. 1.2 |
| Dual Band Amethyst | |
| **Michael Hansen, Ray Collins, Ralf Lorenzen-Scheil** | Page 1 of 2 |

RX SIGNAL PATH
TX SIGNAL PATH
MAIN VCO SIGNAL PATH
TUNING VOLTAGES
REFERENCE CLOCK
Orderable Part
Non - Orderable Part

# Dual Band T191

## HERCULES U1

To U84 / U90 — TCXOEN — E11
From Omega — ON_OFF — D6
To RF Side — RX_ON — C6
TX_ON — E6
DCS_T/R — E9
GSM_T/R — B11
BS2 — D11
PC — B12
BS1 — B13
LE — H10
Test Points 1 to 8
To / From Omega — S_IO — J13
S_RST — K14
S_CLK — J14
NRESET — G3
From U61 — 13Mhz — G14
To Omega — 13MOUT — H14
VCLKRX — G11
VDX — H12
VDR — H13
VFSRX — H11
RST, CLK, DI, DO

ACT
JTAG
SIM
TIMER
VOICEBAND Interface
DAI Digt. Aud. Int.
Radio Int.
F12, F13, F14, G13
POWER
ARM 7
2M RAM
DSP
MEM I/FACE
RTC
PWT
PWL
UART
IIC Inter IC Cntl.
GPIO
SPI

X1
RTCINT — E10
BU — A11
BL — C2
TXDO — B1
RXDO — D2
SCL — D3
SDA — F4
NRSTOUT — C4
IO0VIBRATOR — K11
IO1BATID_DET — J1
IO3DATA_HP_SEL — J3
IO13ACCIN — M6
NRAMCS — A7
NBLE — P7
NBHE — K8
RNW — K7
NFOE — N8
NROMCS1 — L8
FDP — P6
DATA BUS — M9
ADD BUS — B4
ROW4
COL 0 - COL 4
ROW 0 - ROW 3
DATA CLK (To From U61)

U6 SRAM 1Mbit — B5, A1, B2, G5, A2 — DATA BUS, ADD BUS, VR2
U5 FLASH MEMORY 32Mbit — B3, D8, D7, B4 — DATA BUS, ADD BUS, VR2

BDR / BDX / BFSX / BFSR
Hercules / Omega Control SPI BUS

U13 ALERT — VBAT
BQ3 — BU
BQ4 — IO0VIBRATOR
VIBRATOR M1 — VBAT

VBATBB
BL — U7 — BQ2
LCD Backlights
Keypad Backlights

J2 LCD Connector
VLCD — C34 — 1
GND — 2
GND — 3
SCL — 4
SDA — 5
NRSTOUT — 6
VR2 — 7
VR2 — 8
N/C — 9
N/C — 10

(To Omega) VCHG
J1 POWER JACK — 1 2 3 4
HWID (To Omega)
F1
C48
U17 — G1, S1, D1
U18 — G1, S1, D1
U18 — G2, S2, D2
U17 — G2, S2, D2
R62
R77 (Decides if unit is for EMEA or ASIA)
VR3
U16 — G1, S1, D1
R65
D1

Normal Charge
Trigger Charge (Phase 1 - Charging)
Trigger Charge (Phase 2 - Complete)
Over Voltage Mode

COL 0 - COL 4
ROW 0 - ROW 3
KEYPAD MATRIX

RTC BATTERY
U4A

From VBATBB — VCC1 K3, VCC2 D2, VCC3 G3
VR1B — C1
VR2B — D1
VR2 — E1
VR1 — H1
VR3 — H10

BACKUP
VR1B - 2.0V
VR2B - 2.0V
VR2 - 2.9V
VR1 - 1.8V
VR3 - 2.9V
BASEBAND SERIAL PORT
BASEBAND UPLINK — TXI, TXI, TXQ, TXQ — To U61
BASEBAND DOWNLINK — RXI, RXI, RXQ, RXQ — From U61
OMEGA U3
SPI
AFC
APC
IBIC BUS CNTL
TSP — 13MOUT
Battery Charger. Int — ICTL, VBAT, VCHG
USP Micro Proc. Ser. Port — VCLKRX, VDX, VFSRX, VDR — To / From Hercules
SIM I/Face 3V / 5V LEVEL SHIFTERS — S_IO, S_RST, S_CLK — To / From Hercules
ADC Analog/Digital Converter
VRPC Volt. Reg. and Power up Ctnl.
SIM CONTACTS U2 — CLK, RST, I/O, VSIM

I03DATA_HP_SEL
(RX Downlink) RXDO
AFC To U85
RAMP To U74
U8
IO13ACCIN
J3 Audio Jack
VR3
X2 MIC
U14
VR2B_SW
LS1 SPKR
U10
TXDO (TX Downlink)
VOICE UPLINK
VOICE DOWNLINK

HWID
TR1
TBAT
BATID
NRESET
RTCINT
ON_OFF (To Hercules)
PWON (To Power Switch - S19)

BATTERY CONNECTOR JP1 — 1 2 3 4
VBATBB (To Omega)
(To Hercules) ROW4
PWON — S19
U15 — IO1BATID_DET

GSM Service Support Level 3 Authorized

RX SIGNAL PATH
TX SIGNAL PATH
MAIN VCO SIGNAL PATH
TUNING VOLTAGES
REFERENCE CLOCK
Orderable Part
Non - Orderable Part

| | |
|---|---|
| GSM SERVICE SUPPORT GROUP | 01.11.13 |
| LEVEL 3 AL Block Diagram | Rev. 1.2 |
| Dual Band Amethyst | |
| **Michael Hansen, Ray Collins, Ralf Lorenzen-Scheil** | Page 2 of 2 |